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NWC TP 4143
Part 5

AD852896

STORAGE TEMPERATURE OF EXPLOSIVE HAZARD MAGAZINES

Part 5. CARIBBEAN AND MID-ATLANTIC

by

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and
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ABSTRACT. Storage magazine temperature measurements (140,920 data points) from Cuba, Puerto Rico, Bermuda, and the Azores are under study. This data collection is for the purpose of establishing a temperature criterion by statistical methods for ordnance stored in explosive hazard magazines.

This report is the fifth of the series of reports that covers explosive hazard magazine storage temperatures in most parts of the world. This report includes 24 figures and 17 tables.

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M. R. Etheridge, Capt., USN .... Commander

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FOREWORD

This report (Part 5) covers work accomplished by the Naval Weapons Center (NWC), China Lake, California, to determine the valid temperature environment of ordnance stored in "explosive hazard magazines" located in Cuba, Puerto Rico, Bermuda, and the Azores. It is the fifth in a series of reports (NWC TP 4143) and follows Part 1, American Desert; Part 2, Western Pacific; Part 3, Okinawa and Japan; and Part 4, Cold Extremes.

It is expected that there will be sufficient interest generated among ordnance designers to warrant continued work in the study of storage temperatures in the areas already covered and in other areas.

This work was supported by Task Assignment Number A-33-536-711/216-1/F009-06-01.

This report has been reviewed for technical accuracy by Warren W. Oshel.

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Special acknowledgment is due Mrs. Ruth Massaro who has generated, via computer equipment, the pertinent graphs and statistics presented in this report.

CONTENTS

Introduction 1

Instrumentation 2

Method of Data Retrieval and Reduction 2

Results 2

Conclusions 9

Appendixes:

A Data Handling 11

B Monthly Temperature Summaries 15

C Classification of Magazines 23

D Applicable Statistics 37

E Statistical Notes and Implications 57

INTRODUCTION

Environmental temperature criteria are a major controlling factor in the design of all types of ordnance. However, the accepted temperature criteria, as set forth in Military Specifications, may be such that there are ordnance that actually meet the needs of our Naval services and yet have failed over-strenuous qualification requirements. If accurate knowledge of the thermodynamic interplay between the atmospheric temperature and the ordnance hardware temperature is known, more realistic design criteria can be assigned. It is therefore important that the actual temperature environment of ordnance be investigated to determine realistic limitations of thermal exposure relative to in-Fleet service. Realistic qualification tests can then be formulated to simulate the known service conditions. Accomplishment of the foregoing suggestions can then be used to either (1) authenticate the existing Military Specifications or (2) make more realistic the criteria set forth in those specifications.

The first four parts of this report, American Desert, Western Pacific, Okinawa and Japan, and Cold Extremes, have encompassed the range of temperatures to which ordnance are exposed in storage magazines. It was found that in the storage magazines, the MIL-STD high temperature of 165°F and the low temperature of -65°F are not realistic. This report includes temperatures from storage magazines located in the Caribbean and Mid-Atlantic and also validates the findings in the first four parts. The data are available because of the requirement set forth in Naval Ordnance Systems Command publication OP5, "Ammunition Ashore, Handling, Storage and Shipping", which defines a requirement for recording and returning magazine maximum and minimum air temperature records.

This report covers a comparatively small area of the storage environment of explosive ordnance. Storage temperatures were obtained by personnel at the Naval Air Station (NAS), Guantanamo Bay, Cuba; Naval Station (NS), Roosevelt Roads, Puerto Rico; Naval Station (NS), Bermuda; and the Naval Air Facility (NAF), Lajes, Azores, for use in their ammunition safety programs.

The data reported herein are comprised of the measured air temperatures inside the described structures only. Any ordnance stored in these structures cannot be expected to thermally follow the variations in temperature of the enclosed air. The difference in mass between the air and ordnance can be expected to prevent this. Therefore, any temperatures herein reported can be treated as "conservative" for the temperature of the ordnance stored in these explosive hazard magazines. (In general, the temperature of the ordnance hardware will tend to follow the mean daily air temperature within the storage structure rather than the maximum and minimum recorded air temperatures.)

INSTRUMENTATION

The magazine temperature data were obtained through the use of "horseshoe" maximum and minimum mercury thermometers. These thermometers are equipped with steel "tattletale" devices that float on the mercury and remain at the highest and lowest temperature positions reached during the measurement period. The ordnancemen reset the tattletales with a magnet after reading the indicated maximum and minimum temperature for the measurement period. The manufacturers of the thermometers (Taylor, Weksler, and Moeller) warrant that the temperature readings are accurate to within 2°F at the time of delivery. These thermometers are generally mounted on the inside forward face of the back wall of the storage magazines at about eye level (standard procedure).

Nonstandard magazines, such as buried transportainers, may not allow the placement of the thermometers at the standard locations within the magazine. Thermometers have been observed to be mounted on boards, or even bare, and situated for convenience even in "standard" types of magazines.

METHOD OF DATA RETRIEVAL AND REDUCTION

All available storage magazine temperature data from the NAS, Guantanamo Bay, Cuba; NS, Roosevelt Roads, Puerto Rico; NS, Bermuda; and NAF, Lajes, Azores, were collected and sent to the Analysis Branch, Propulsion Development Department at NWC. The raw data were reduced to meaningful statistics and the significant points of interest for each location were tabulated. These were (1) the number of temperature measurements collected, (2) the number of measured temperatures greater than or equal to 90, 100, and 110°F for each month, and (3) the average maximum and the average minimum temperature for each month. The method used in processing the data is explained in detail in Appendix A.

RESULTS

A summation of the temperature readings greater than or equal to 90, 100, and 110°F (the maximum recorded temperature) and the minimum recorded temperature from both earth-covered and non-earth-covered magazines located in Cuba, Puerto Rico, Bermuda, and Azores is presented in Table 1. The detailed monthly breakdowns from which the data in Table 1 were summarized are presented in Appendix B.

TABLE 1. Data Summary by Station and Magazine Type

Storage locations	Magazine type	Months[a]	N[b]	No. of max temperatures greater than or equal to			Recorded temperature (°F)	
				90°F	100°F	110°F	Max	Min
Naval Air Station Guantanamo Bay Cuba	Earth covered	39	8,861	1,043	1	0	100	60
	Non-earth covered	21	2,537	222	0	0	98	55
Naval Station Roosevelt Roads Puerto Rico	Earth covered	38	98,515	15,929	27	1	110	52
	Non-earth covered	30	5,472	1,359	3	0	102	55
Naval Station Bermuda	Earth covered	31	15,177	559	0	0	98	47
	Non-earth covered	33	2,741	202	0	0	98	40
Naval Air Facility Azores	Earth covered	37	7,616	0	0	0	86	35

[a]Length of time in months.

[b]Number of data points represented in the sample.

The results presented in Table 1 give an indication of temperatures to be expected in explosive hazard magazines at locations indicated. Some of the differences in temperatures between locations is due to the construction of the individual storage magazines. Descriptions of the magazine classifications pertinent to this report are given in Appendix C.

The average maximum and minimum temperatures of each month for the four magazine sites are shown in Fig. 1 through 9. Figures 1, 3, 5, 7, and 8 are data reported from earth-covered explosive hazard magazines at these various locations. Figures 2, 4, 6, and 9 are the data reported from the non-earth-covered magazines. Figures 8 and 9 are collections of data from both Cuba and Puerto Rico; the data are combined because of the similarity in the environment. The upper lines in Fig. 1 through 9 represent the monthly observed average maximums and the lower lines represent the observed average minimums.

The data which support the plots of Fig. 1 through 9 are included in Appendix D. These data include the number of measured points from which the averages and the standard deviations were computed. The standard deviations of the data for Fig. 8 and 9 are not given because Fig. 8 represents a collection of the data from Fig. 1 and 3, and Fig. 9 a collection of the data from Fig. 2 and 4.

The importance of reporting these data and the implications arising therefrom are discussed in Appendix E.

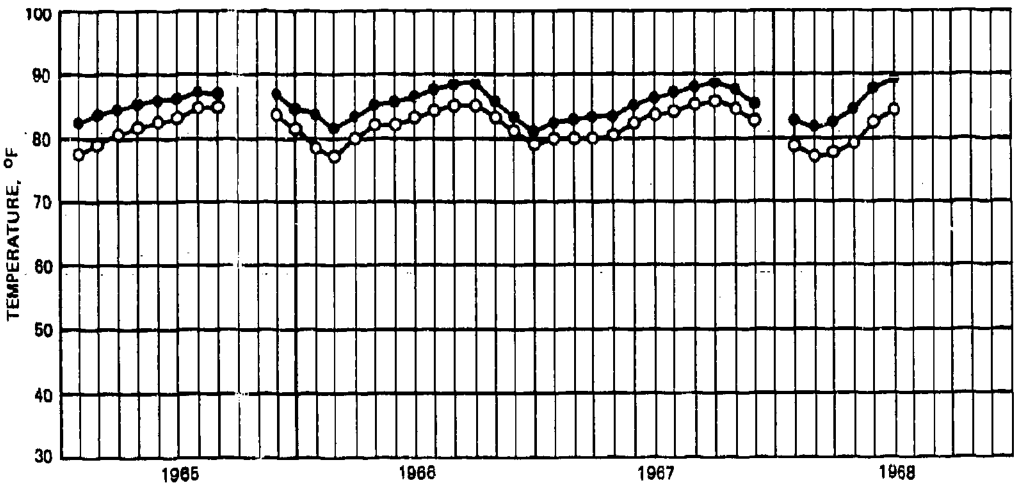


FIG. 1. The Average Maximum and Average Minimum Temperatures of Earth-Covered Magazines at NAS, Cuba.

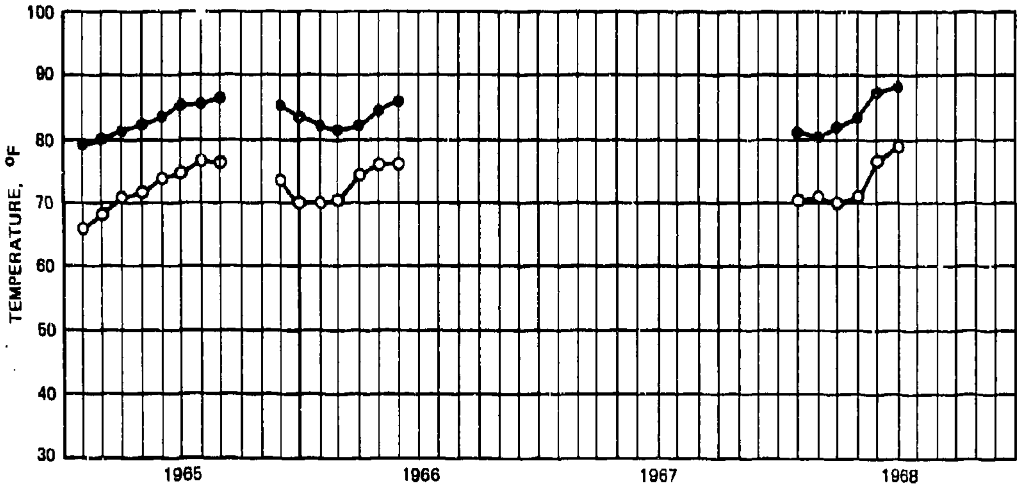


FIG. 2. The Average Maximum and Average Minimum Temperatures of Non-Earth-Covered Magazines at NAS, Cuba.

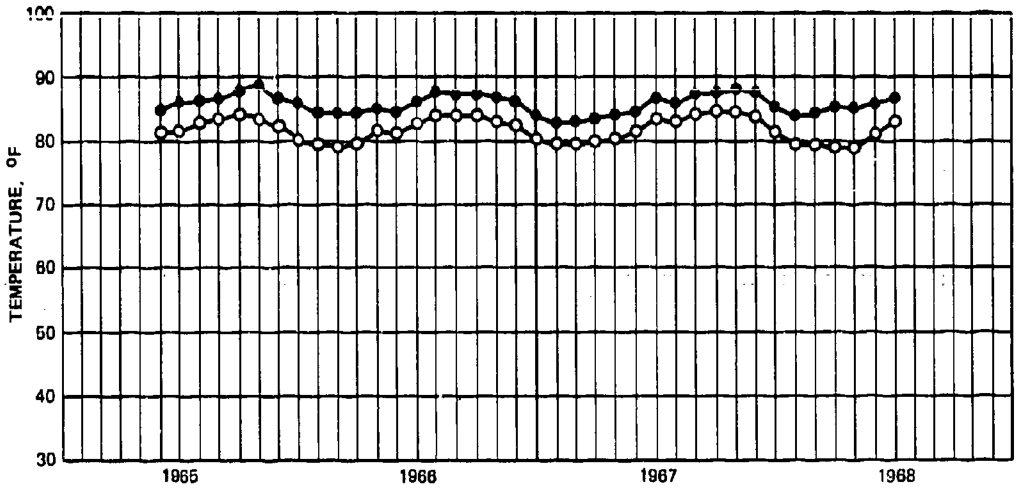


FIG. 3. The Average Maximum and Average Minimum Temperatures of Earth-Covered Magazines at NS, Puerto Rico.

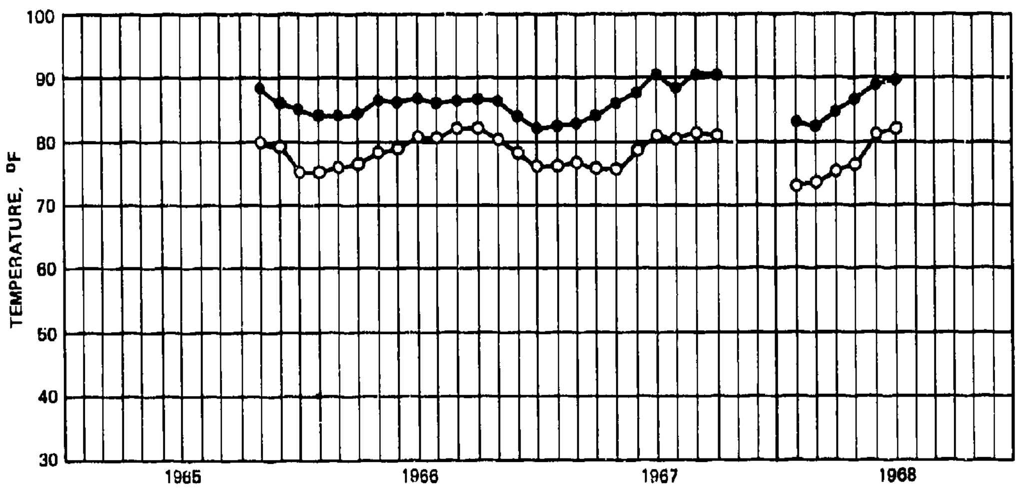


FIG. 4. The Average Maximum and Average Minimum Temperatures of Non-Earth-Covered Magazines at NS, Puerto Rico.

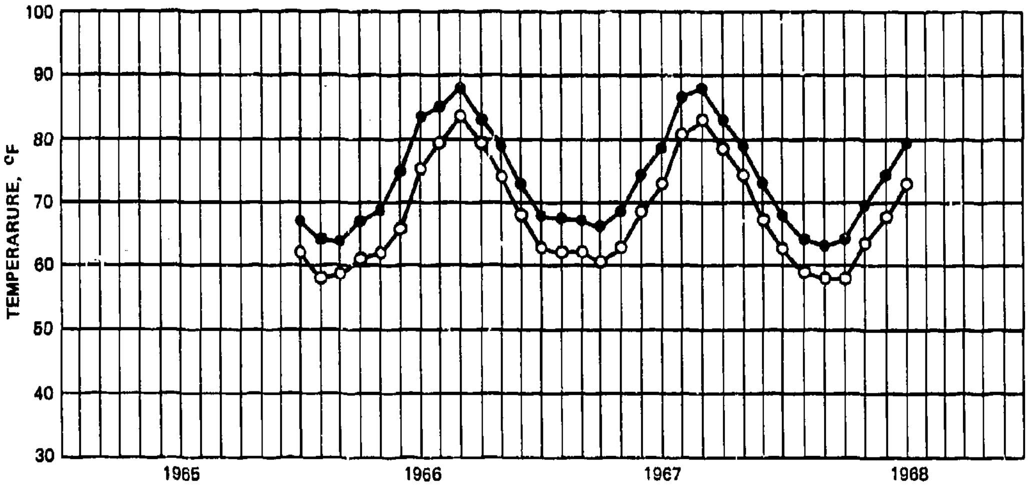


FIG. 5. The Average Maximum and Average Minimum Temperatures of Earth-Covered Magazines at NS, Bermuda.

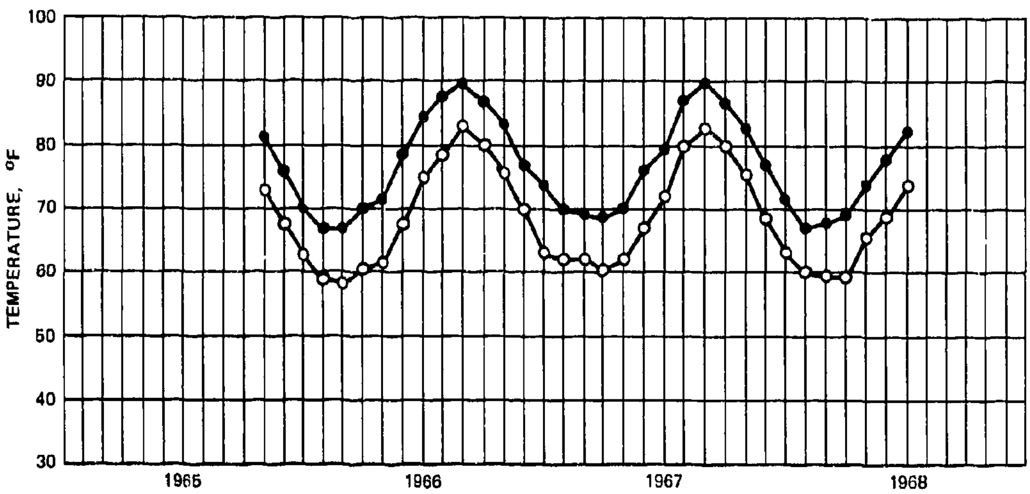


FIG. 6. The Average Maximum and Average Minimum Temperatures of Non-Earth-Covered Magazines at NS, Bermuda.

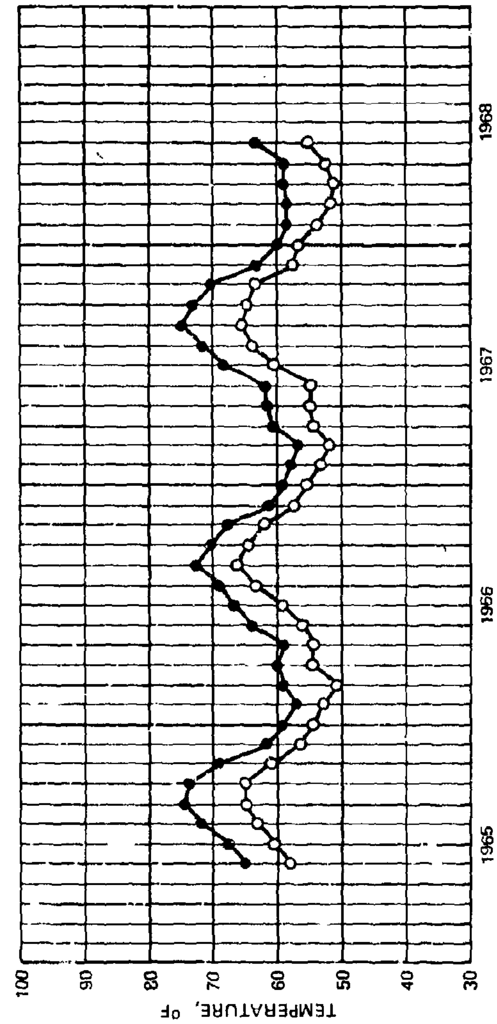


FIG. 7. The Average Maximum and Average Minimum Temperatures of Earth-Covered Magazines at NAF, Azores.

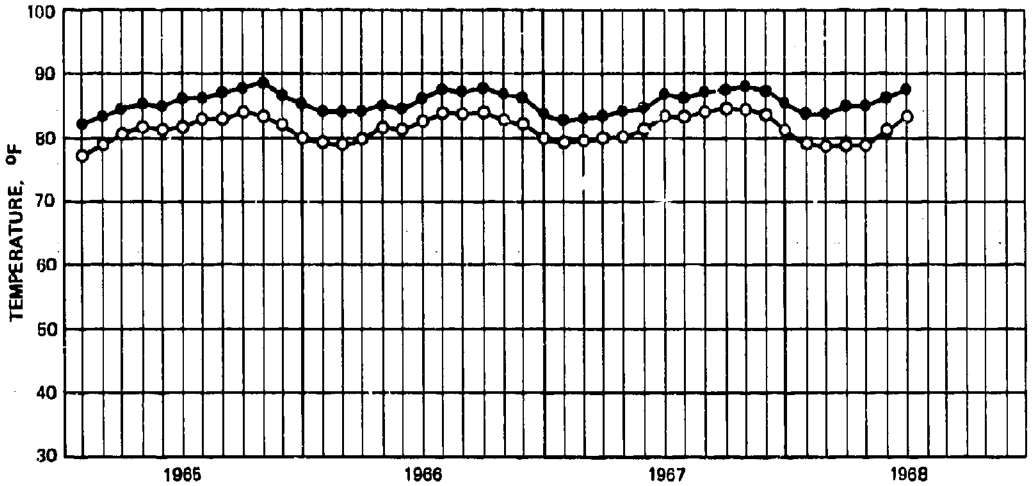


FIG. 8. The Average Maximum and Average Minimum Temperatures of Earth-Covered Magazines at Both NAS, Cuba and NS, Puerto Rico.

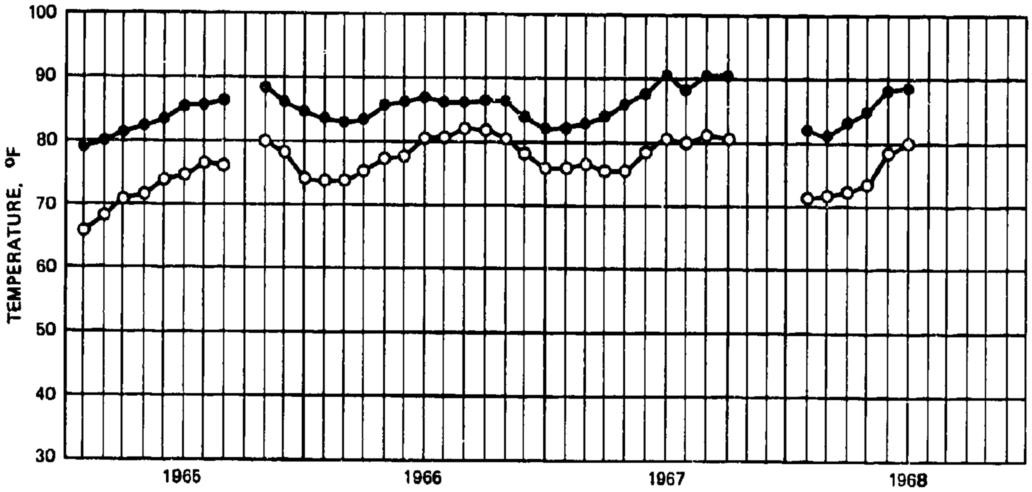


FIG. 9. The Average Maximum and Average Minimum Temperatures of Non-Earth-Covered Magazines at Both NAS, Cuba and NS, Puerto Rico.

CONCLUSIONS

Assuming that the data are representative of the enclosed air temperatures encountered in the explosive hazard magazines located in Cuba, Puerto Rico, Bermuda, and Azores, the results indicate that ordnance, explosives, propellants, pyrotechnics, etc., stored in these storage magazines will probably never be subjected to temperatures below 30°F or above 110°F (see Appendix D). It can be seen in Fig. 1 through 9 that the data displayed in this report were taken from two types of structures; earth-covered and non-earth-covered. The magazines are of metal and concrete construction. The records indicate a consistent difference in temperature ranges and daily fluctuations between the earth-covered and non-earth-covered magazines at a given site. There is a great difference between the outside air temperature and the temperature inside the magazines in all cases. These differences, for the purpose of protection from the elements, are almost the same regardless of the type of magazine. It appears that any sort of covering protects the ordnance from the ambient extremes.

Parts 1, 2, 3, 4, and 5 of this series of reports have, to a large extent, statistically established that explosive hazard ordnance, stored in magazines among existing Naval stations throughout the world, are not being subjected to the -65°F minimum or +165°F maximum temperatures specified in Military Specifications for ordnance design.

Appendix A

DATA HANDLING

The procedure for handling the storage temperature data is as follows:

Step 1. The applicable data are key punched onto IBM type cards from the temperature summary sheets as received from the ammunition storage facility as shown in Table 2.

TABLE 2. Punchcard Data

	Month	Day	Year	Type of magazine	Temp reading		Storage location
					Low	High	
Example	08	01	65	13BC1	83	84	NAS, Cuba
Card column	3 ---	------	--- 8	18-26	36-38	42-44	55-79

Step 2. The punched cards (Step 1) are sorted in the following manner:

a. Storage location: e.g., NS, Bermuda, NAF, Azores.

b. Type of magazine: earth-covered or non-earth-covered.

c. Calendar sequence: Month, day, and year.

Step 3. The input and output for a computer run are:

a. Input:

(1) Computer program (420-052).
(2) Total card: number of months.
(3) Sorted cards from Step 2.

b. Output:

(1) Averages and standard deviations of maximum and minimum temperatures of each month on cards, as shown in Fig. 10.

(2) Raw data information, as shown on microfilm, Fig. 11.

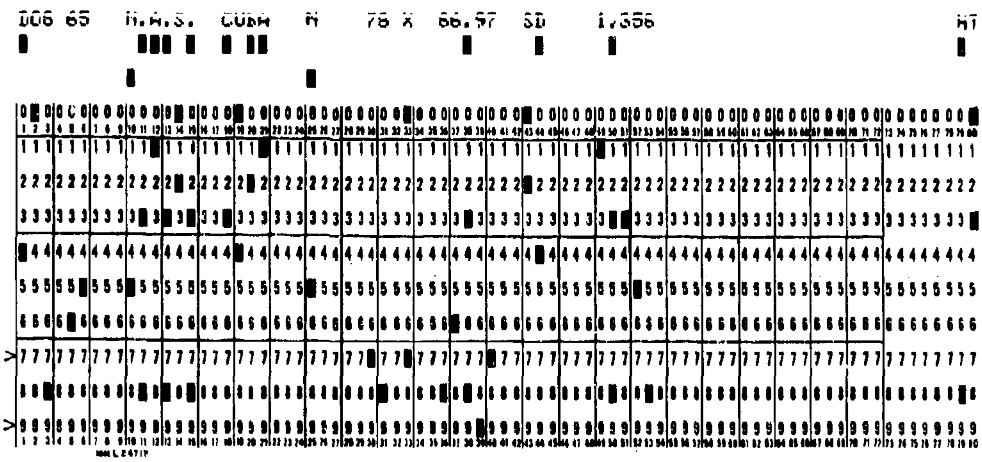
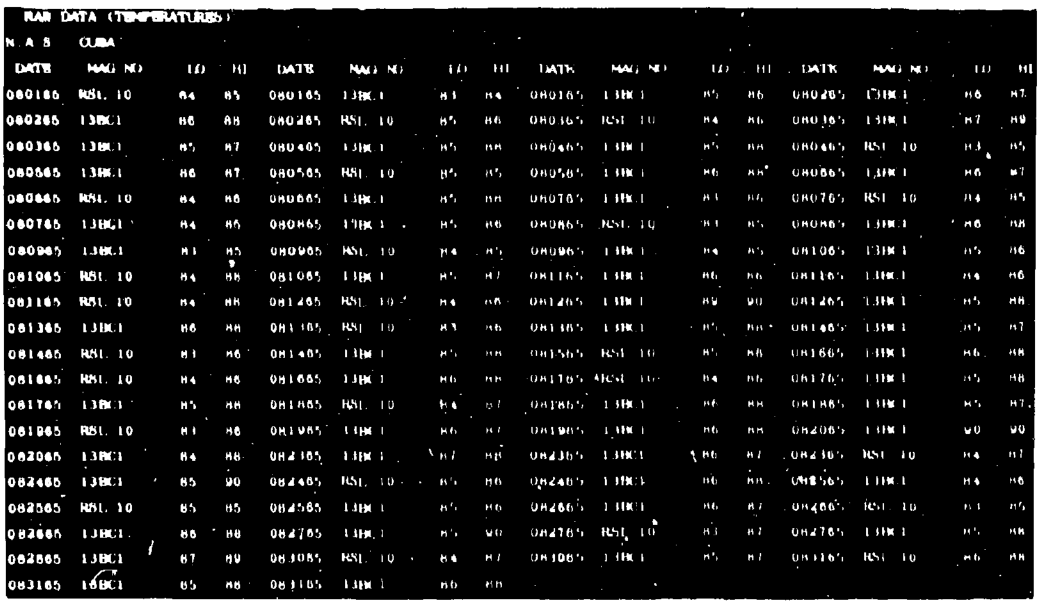


FIG. 10. Typical $\overline{x}$, s Card.



RAW DATA (TEMPERATURES)

N.A.S. CUBA

DATE	MAG NO	LO	HI	DATE	MAG NO	LO	HI	DATE	MAG NO	LO	HI	DATE	MAG NO	LO	HI
080165	RSL 10	84	85	080165	13BC1	81	84	080165	13BC1	85	86	080265	13BC1	86	87
080265	13BC1	86	88	080265	RSL 10	85	86	080365	RSL 10	84	86	080365	13BC1	87	89
080365	13BC1	85	87	080465	13BC1	85	88	080465	13BC1	85	88	080465	RSL 10	83	85
080565	13BC1	86	87	080565	RSL 10	85	85	080565	13BC1	86	88	080665	13BC1	86	87
080665	RSL 10	84	86	080665	13BC1	85	88	080765	13BC1	83	86	080765	RSL 10	84	85
080765	13BC1	84	86	080865	13BC1	85	86	080865	RSL 10	81	85	080865	13BC1	86	88
080965	13BC1	81	85	080965	RSL 10	84	85	080965	13BC1	84	85	081065	13BC1	85	86
081065	RSL 10	84	88	081065	13BC1	85	87	081165	13BC1	86	86	081165	13BC1	84	86
081165	RSL 10	84	88	081265	RSL 10	84	88	081265	13BC1	89	90	081265	13BC1	85	88
081365	13BC1	86	88	081365	RSL 10	83	86	081365	13BC1	85	86	081465	13BC1	85	87
081465	RSL 10	81	86	081465	13BC1	85	88	081565	RSL 10	85	88	081665	13BC1	86	88
081665	RSL 10	84	86	081665	13BC1	86	88	081765	RSL 10	84	86	081765	13BC1	85	88
081765	13BC1	85	88	081865	RSL 10	84	87	081865	13BC1	86	88	081865	13BC1	85	87
081965	RSL 10	81	86	081965	13BC1	86	87	081965	13BC1	86	88	082065	13BC1	90	90
082065	13BC1	84	88	082165	13BC1	87	88	082365	13BC1	86	87	082365	RSL 10	84	87
082465	13BC1	85	90	082465	RSL 10	85	86	082465	13BC1	86	88	082565	13BC1	84	86
082565	RSL 10	85	85	082565	13BC1	85	86	082665	13BC1	86	87	082665	RSL 10	81	85
082665	13BC1	86	88	082765	13BC1	85	90	082765	RSL 10	83	87	082765	13BC1	85	88
082865	13BC1	87	89	083065	RSL 10	84	87	083065	13BC1	85	87	083165	RSL 10	86	88
083165	13BC1	85	88	083165	13BC1	86	88								

FIG. 11. Raw Data on Microfilm.

(3) Maximum and minimum temperature data for each month. The maximum temperature data labeled "High temperature", as shown on microfilm, Fig. 12.

(4) Deck of cards which carries the necessary identification for mounting the microfilm on the aperture card.

Step 4. The identification punched into the output decks created in Step 3b(2) and (3) are cut into segments and mounted on aperture cards as shown in Fig. 13 and 14.

Step 5. The output deck (Step 3b(1)) is assembled for the computer program (420-053) and fed into the Univac 1108 computer. The output is a curve plot, similar to Fig. 1, which gives average maximum and minimum temperatures for the effective dates of output deck data retention. A microfilm of the curve is produced and mounted on an aperture card.

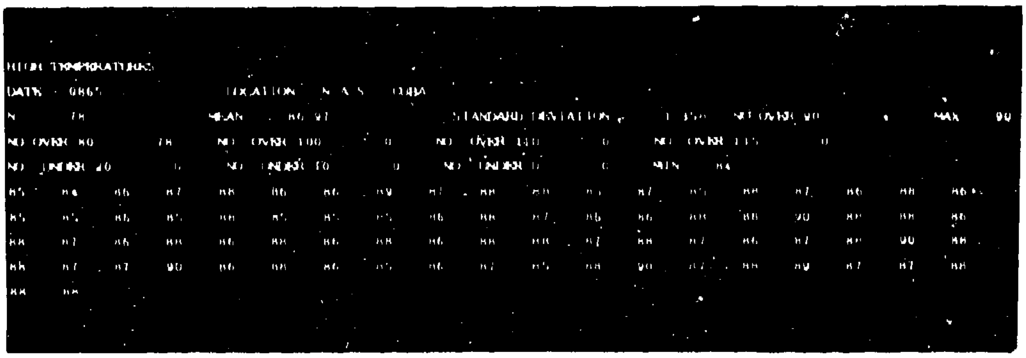


FIG. 12. Data on Microfilm.

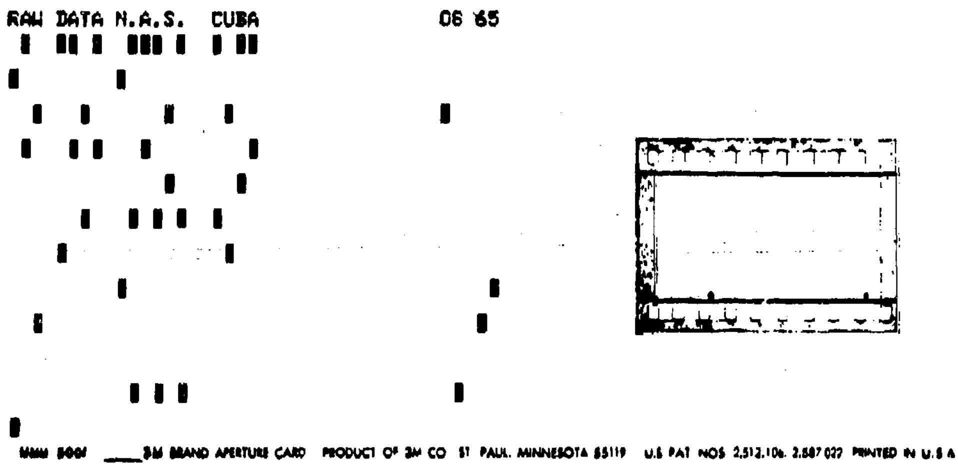


FIG. 13. Aperture Card With Microfilm Insert of Raw Data Shown in Fig. 11.

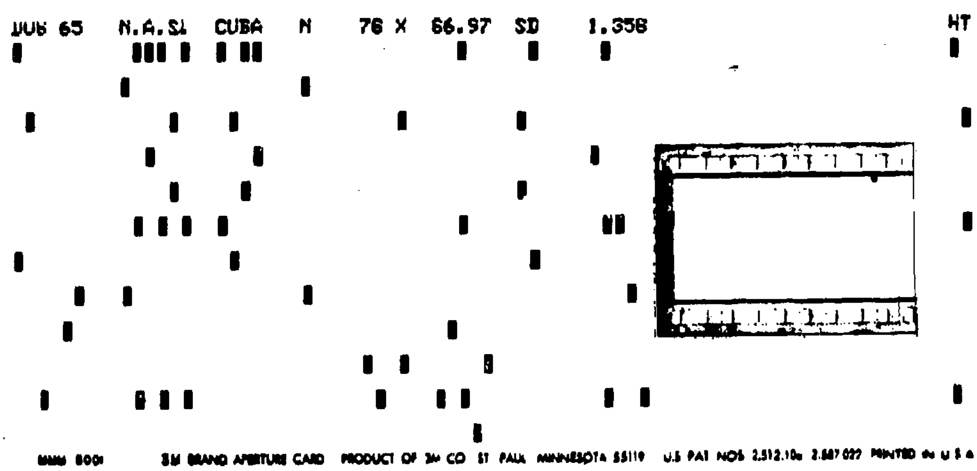


FIG. 14. Aperture Card With Microfilm Insert of Data Shown in Fig. 12.

Appendix B

MONTHLY TEMPERATURE SUMMARIES

The monthly breakdown of the summary of results for each location is presented in Tables 3 through 9. The first row of each table contains column headings. Reading from the left, the first two column headings "year" and "Month" are self-explanatory. "N" indicates the number of temperature readings taken during the month, the fourth through the sixth column labeled "The Number of Data Points Greater Than or Equal to 90, 100, and 110°F" is self-explanatory. "Max Temp" indicates the highest temperature that was recorded during the month.

TABLE 3. Summary of Results, Earth-Covered Magazines, NAS, Guantanamo Bay, Cuba

Year	Month	N	Number of data points greater than or equal to 90°F	100°F	110°F	Max temp
1965	01	177	0	0	0	88
1965	02	212	1	0	0	92
1965	03	246	12	0	0	91
1965	04	220	24	0	0	92
1965	05	220	25	0	0	92
1965	06	225	26	0	0	95
1965	07	241	34	0	0	94
1965	08	78	4	0	0	90
1965	11	117	14	0	0	92
1965	12	112	0	0	0	89
1966	01	140	9	0	0	95
1966	02	137	0	0	0	89
1966	03	166	3	0	0	96
1966	04	155	15	0	0	94
1966	05	160	23	0	0	94
1966	06	143	17	0	0	95
1966	07	141	33	0	0	94
1966	08	154	31	0	0	95
1966	09	133	43	0	0	94
1966	10	147	5	0	0	93
1966	11	123	0	0	0	88
1966	12	159	0	0	0	84
1967	01	179	7	0	0	95
1967	02	170	3	0	0	96
1967	03	188	3	0	0	95
1967	04	190	2	0	0	95
1967	05	190	10	0	0	90
1967	06	202	18	0	0	92
1967	07	214	26	0	0	92
1967	08	217	57	0	0	90
1967	09	208	87	1	0	100
1967	10	214	25	0	0	92
1967	11	209	1	0	0	90
1968	01	403	1	0	0	90
1968	02	454	1	0	0	90
1968	03	559	1	0	0	90
1968	04	565	7	0	0	92
1968	05	767	277	0	0	95
1968	06	326	198	0	0	95

TABLE 4. Summary of Results, Non-Earth-Covered Magazines, NAS, Guantanamo Bay, Cuba

Year	Month	N	Number of data points greater than or equal to 90°F	100°F	110°F	Max temp
1965	01	71	0	0	0	86
1965	02	108	0	0	0	88
1965	03	125	0	0	0	88
1965	04	101	0	0	0	89
1965	05	108	0	0	0	89
1965	06	107	1	0	0	90
1965	07	112	3	0	0	90
1965	08	93	20	0	0	97
1965	11	40	2	0	0	90
1965	12	46	0	0	0	88
1966	01	63	2	0	0	90
1966	02	116	4	0	0	92
1966	03	148	10	0	0	90
1966	04	141	18	0	0	92
1966	05	128	24	0	0	98
1968	01	184	1	0	0	94
1968	02	204	5	0	0	96
1968	03	186	0	0	0	88
1968	04	151	10	0	0	92
1968	05	155	57	0	0	98
1968	06	150	65	0	0	97

TABLE 5. Summary of Results, Earth-Covered Magazines, NS, Roosevelt Roads, Puerto Rico

Year	Month	N	Number of data points greater than or equal to			Max temp
			90°F	100°F	110°F	
1965	05	1512	180	1	0	100
1965	06	1753	300	0	0	98
1965	07	1758	322	1	0	102
1965	08	2051	393	0	0	99
1965	09	2078	697	1	0	100
1965	10	2127	958	2	1	110
1965	11	2582	619	2	0	107
1965	12	2831	498	1	0	100
1966	01	2794	239	0	0	99
1966	02	2421	130	1	0	100
1966	03	2776	155	0	0	98
1966	04	2643	185	0	0	99
1966	05	2875	86	0	0	96
1966	06	2865	283	2	0	102
1966	07	2875	652	0	0	96
1966	08	2907	658	2	0	100
1966	09	2716	703	0	0	98
1966	10	2791	744	0	0	98
1966	11	2783	691	8	0	106
1966	12	2908	248	0	0	96
1967	01	2917	84	0	0	94
1967	02	2649	71	1	0	102
1967	03	2930	97	0	0	96
1967	04	2803	152	1	0	102
1967	05	2857	164	0	0	98
1967	06	2795	496	2	0	102
1967	07	3011	282	0	0	98
1967	08	2901	697	0	0	99
1967	09	2899	781	2	0	100
1967	10	2452	980	0	0	98
1967	11	2278	787	0	0	96
1967	12	2580	500	0	0	99
1968	01	2901	217	0	0	96
1968	02	2953	317	0	0	98
1968	03	3082	632	0	0	96
1968	04	2897	517	0	0	98
1968	05	3039	334	0	0	98
1968	06	524	80	0	0	98

TABLE 6. Summary of Results, Non-Earth-Covered Magazines, NS, Roosevelt Roads, Puerto Rico

Year	Month	N	Number of data points greater than or equal to			Max temp
			90°F	100°F	110°F	
1965	10	136	64	0	0	96
1965	11	177	28	0	0	91
1965	12	201	14	0	0	90
1966	01	207	11	0	0	90
1966	02	196	23	0	0	92
1966	03	207	39	0	0	96
1966	04	203	71	0	0	96
1966	05	202	46	0	0	96
1966	06	204	66	0	0	96
1966	07	87	26	0	0	98
1966	08	209	47	0	0	96
1966	09	203	43	0	0	98
1966	10	197	40	0	0	96
1966	11	221	30	0	0	94
1966	12	210	1	0	0	90
1967	01	210	1	0	0	90
1967	02	191	6	0	0	90
1967	03	213	6	0	0	90
1967	04	196	53	0	0	96
1967	05	201	74	0	0	97
1967	06	188	127	2	0	102
1967	07	155	60	0	0	99
1967	08	192	130	0	0	99
1967	09	174	117	1	0	100
1968	01	151	2	0	0	90
1968	02	135	3	0	0	92
1968	03	155	26	0	0	95
1968	04	153	38	0	0	98
1968	05	155	79	0	0	99
1968	06	143	88	0	0	99

TABLE 7. Summary of Results, Earth-Covered Magazines, NS, Bermuda

Year	Month	N	Number of data points greater than or equal to			Max temp
			90°F	100°F	110°F	
1965	12	744	0	0	0	77
1966	01	580	0	0	0	79
1966	02	504	0	0	0	74
1966	03	391	0	0	0	72
1966	04	357	0	0	0	76
1966	05	399	0	0	0	86
1966	06	396	39	0	0	94
1966	07	366	23	0	0	92
1966	08	412	103	0	0	98
1966	09	378	5	0	0	93
1966	10	375	0	0	0	89
1966	11	360	0	0	0	82
1966	12	378	0	0	0	78
1967	01	360	0	0	0	80
1967	02	497	0	0	0	83
1967	03	645	0	0	0	76
1967	04	540	0	0	0	77
1967	05	594	0	0	0	85
1967	06	625	16	0	0	92
1967	07	560	137	0	0	96
1967	08	640	205	0	0	96
1967	09	542	20	0	0	96
1967	10	572	6	0	0	95
1967	11	520	0	0	0	85
1967	12	519	0	0	0	83
1968	01	550	0	0	0	78
1968	02	500	0	0	0	72
1968	03	480	0	0	0	78
1968	04	570	0	0	0	79
1968	05	565	0	0	0	86
1968	06	259	5	0	0	90

TABLE 8. Summary of Results, Non-Earth-Covered Magazines, NS, Bermuda

Year	Month	N	Number of data points greater than or equal to			Max temp
			90°F	100°F	110°F	
1965	10	59	0	0	0	89
1965	11	55	0	0	0	85
1965	12	153	0	0	0	78
1966	01	151	0	0	0	72
1966	02	137	0	0	0	74
1966	03	127	0	0	0	80
1966	04	124	0	0	0	79
1966	05	125	0	0	0	87
1966	06	104	4	0	0	91
1966	07	106	14	0	0	98
1966	08	108	69	0	0	94
1966	09	102	35	0	0	94
1966	10	103	4	0	0	91
1966	11	100	0	0	0	88
1966	12	93	1	0	0	91
1967	01	60	0	0	0	85
1967	02	54	0	0	0	80
1967	03	69	0	0	0	78
1967	04	60	0	0	0	80
1967	05	65	0	0	0	83
1967	06	66	0	0	0	88
1967	07	60	10	0	0	92
1967	08	69	41	0	0	97
1967	09	60	14	0	0	94
1967	10	66	10	0	0	92
1967	11	60	0	0	0	88
1967	12	60	0	0	0	82
1968	01	66	0	0	0	76
1968	02	60	0	0	0	76
1968	03	60	0	0	0	78
1968	04	66	0	0	0	79
1968	05	63	0	0	0	84
1968	06	30	0	0	0	89

TABLE 9. Summary of Results, Earth-Covered Magazines, NAF, Lajes, Azores

Year	Month	N	Number of data points greater than or equal to			Max temp
			90°F	100°F	110°F	
1965	05	227	0	0	0	75
1965	06	250	0	0	0	80
1965	07	245	0	0	0	80
1965	08	239	0	0	0	85
1965	09	211	0	0	0	81
1965	10	173	0	0	0	80
1965	11	205	0	0	0	75
1965	12	164	0	0	0	70
1966	01	194	0	0	0	65
1966	02	231	0	0	0	70
1966	03	252	0	0	0	70
1966	04	219	0	0	0	69
1966	05	192	0	0	0	74
1966	06	213	0	0	0	77
1966	07	211	0	0	0	80
1966	08	215	0	0	0	83
1966	09	215	0	0	0	86
1966	10	161	0	0	0	78
1966	11	168	0	0	0	73
1966	12	159	0	0	0	72
1967	01	205	0	0	0	68
1967	02	201	0	0	0	67
1967	03	247	0	0	0	71
1967	04	191	0	0	0	72
1967	05	242	0	0	0	73
1967	06	226	0	0	0	78
1967	07	212	0	0	0	82
1967	08	236	0	0	0	[illegible]
1967	09	197	0	0	0	[illegible]
1967	10	212	0	0	0	[illegible]
1967	11	203	0	0	0	[illegible]
1967	12	194	0	0	[illegible]	[illegible]
1968	01	176	0	0	0	72
1968	02	169	0	0	0	68
1968	03	170	0	0	0	71
1968	04	217	0	0	0	71
1968	05	174	0	0	0	73

Appendix C

CLASSIFICATION OF MAGAZINES

Storage magazines differ in construction and deployment for the type of ammunition that is to be stored. The storage magazines from which the temperature data have been collected differ greatly in that their classifications range from Explosive Hazard Magazines to storehouses. Their construction, labeling, maintenance, etc., and the frequency at which temperature measurements were taken are in accordance with the document "Ammunition Ashore Handling, Stowing, and Shipping", OP5, Vol. 1, second revision. The letter designations, as established by OP5, are presented in Table 10, so that the reader should have no difficulty in distinguishing between types of magazines that are found at the specified locations.

In order to indicate the type of magazine, OP5 requires that the letter T be added if the magazine is earth-covered and barricaded; the letter C added if the magazine is earth-covered but the door is not barricaded; and the letter S added if the magazine is not earth-covered but is barricaded.

TABLE 10. Storage Magazine Description.

L to N Inclusive and Y Fire Hazard--Powder (Bulk, Semifixed or Bag Ammunition), Pyrotechnics, Ignition Fuzes and Primers, Small Arms, Smoke Drums, Chemical Ammunition

Dimensions (nominal) (ft)	Normal explosive limit (lb)	Letter designator
50 x 100 -----------	500,000 -----------	L
25 x 80 triple arch	500,000 -----------	L
52 dome (Corbetta type)	500,000 -----------	D
50 x 60 -----------	300,000 -----------	M
30 x 50 -----------	125,000 -----------	N
25 x 48 -----------	125,000 -----------	N
25 x 40 -----------	125,000 -----------	N
Miscellaneous or non-standard size	Dependent upon location, size, and construction	Y

TABLE 10. (Contd)

P and Z Missile Hazard--Projectile and Fixed Ammunition

Dimensions (nominal) (ft)	Maximum explosive limit (lb)	Letter designator
50 x 100 -----------	143,000 -----------	P
25 x 80 triple arch	143,000 (total for three arches)	P
52 dome (Corbetta type)	143,000 -----------	D
Miscellaneous or non-standard size	143,000 -----------	Z

A to K Inclusive and W, and X Explosion Hazard--High Explosive (Bulk, Depth Charges, Mines, Warheads, Bombs, etc.) Fuzes, Detonators, Exploders, Black Powder

Dimensions (nominal) (ft)	Normal use	Normal explosive limit (lb)	Letter designator
25 x 80 arch type (igloo)	High explosives	250,000	A
25 x 50 arch type (igloo)	High explosives	143,000	B
25 x 40 arch type (igloo)	High explosives	143,000	B
39 x 44 or 32 x 44 (warhead type)	High explosives	250,000	W
12 x 17 (box type)	Black powder	20,000	E
Miscellaneous or non-standard size	High explosives	Dependent upon size, location, and construction	X
25 x 20 arch type (igloo)	Fuze and detonator	70,000	F
Dimensions vary (gallery or tunnel type)	High explosives	250,000	G
10 x 14	Fuze and detonator	15,000	H
10 x 7	Fuze and detonator	7,500	H
6 x 8-2/3 (keyport type)	High explosives	4,000	K

TABLE 10. (Contd)

Miscellaneous Magazines

Dimensions (nominal) (ft)	Type	Letter designator
25 x 68 -----------	Smoke drum type -----------	SD
25 x 34 -----------	Smoke drum type -----------	SD
25 x 51 -----------	Smoke drum type -----------	SD
	All inert storehouses	SH

Type of hazard	Letter designator
Explosive hazard magazine	X
Fire hazard magazine	Y
Missile hazard magazine	Z

Most naval facilities use storage shelters called Ready Service Lockers (RSL) for supposedly temporary storage. The construction of these shelters differ widely; wooden surface structures to earth covered, concrete structures.

NAVAL AIR STATION, GUANTANAMO BAY, CUBA

There are 25 storage magazines from which temperature data have been reported. Eighteen magazines are earth covered with letter designations BT, FT, BC (Fig. 15), 190, 191, RBL (Fig. 16), RSL (Fig. 17), and AV 106. (It should be noted that some of these designations are not defined in OP5). Seven are non-earth covered magazines with the letter designation RSL.

NAVAL STATION, ROOSEVELT ROADS, PUERTO RICO

There are 97 storage magazines from which temperature data have been reported. Ninety-three magazines are earth covered with letter designations LC, PC (Fig. 18), AT, BT, HT, FC, NC, and XT. Four are non-earth covered magazines with the letter designations SD, Y (Fig. 19), and Z.

NAVAL STATION, BERMUDA

There are approximately 257 storage magazines from which data have been reported. Approximately 254 are earth covered with letter designations CY (Fig. 20) and HTX. Three are non-earth covered magazines with letter designations MY, XS, and MZ (Fig. 21).

NAVAL AIR FACILITY, LAJES, AZORES

There are 11 storage magazines from which temperature data have been reported. They are all earth covered magazines with letter designations YC (Fig. 22), XC (Fig. 22 and 23), and HT.

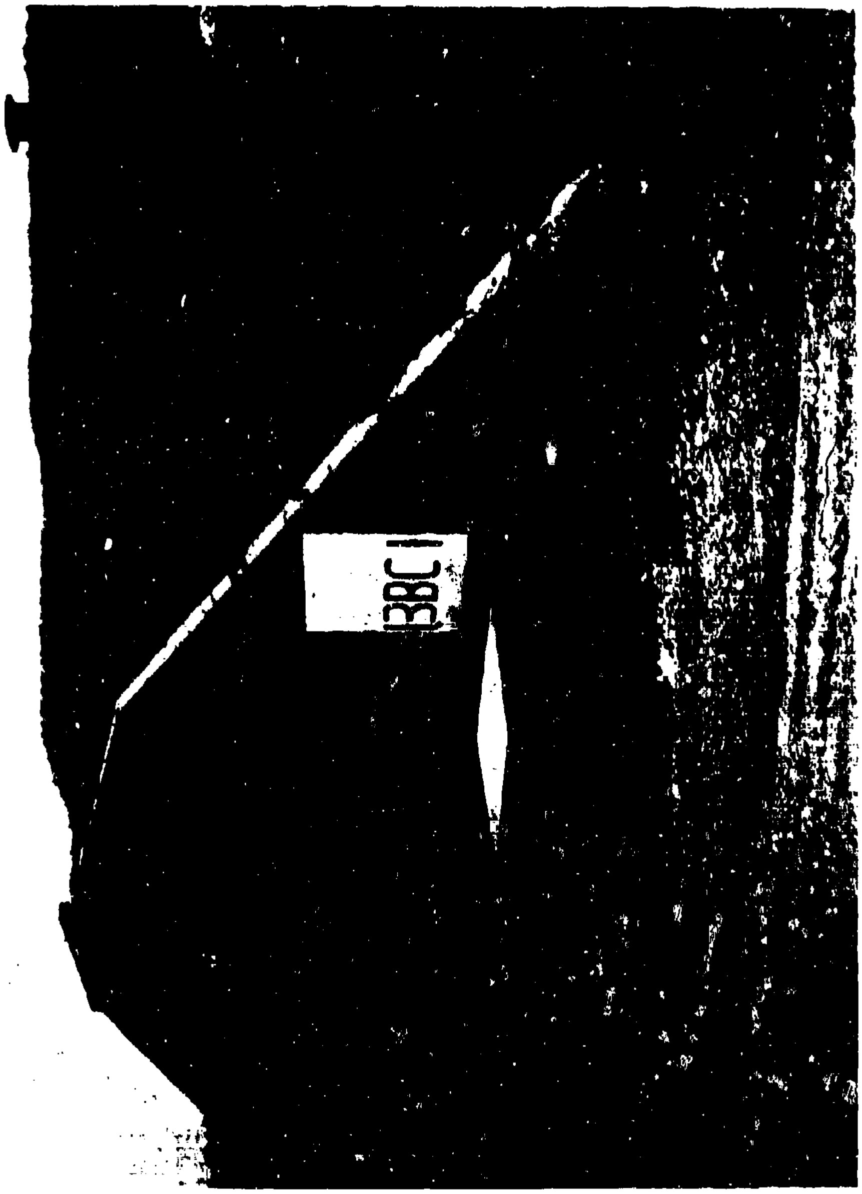


FIG. 15. NAS, Guantanamo Bay, Cuba, Magazine 13BC1.

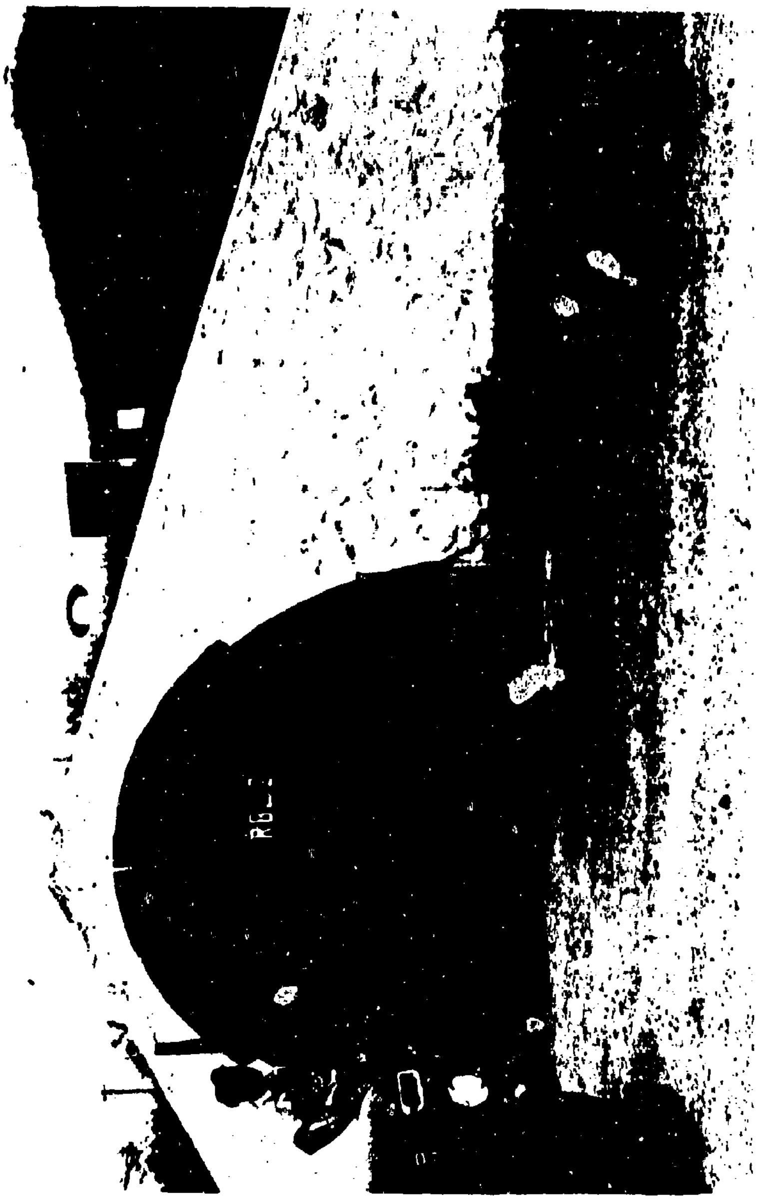


FIG. 16. NAS, Guantanamo Bay, Cuba, Magazine RBL2.

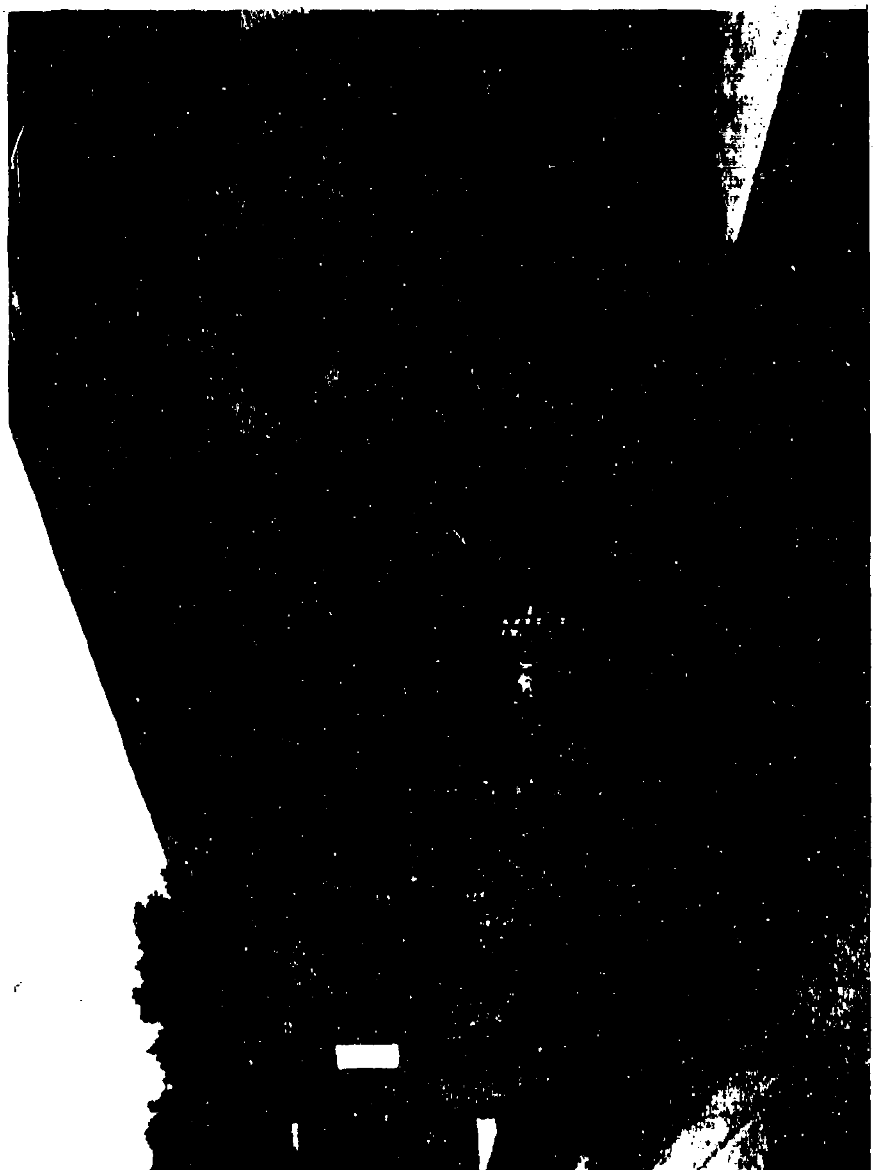


FIG. 17. NAS, Guantanamo Bay, Cuba, Magazines RSL10, RSL11, and RSL11-1/2.

FIG. 18. NS, Roosevelt Roads, Puerto Rico, Magazine 8PC8C.

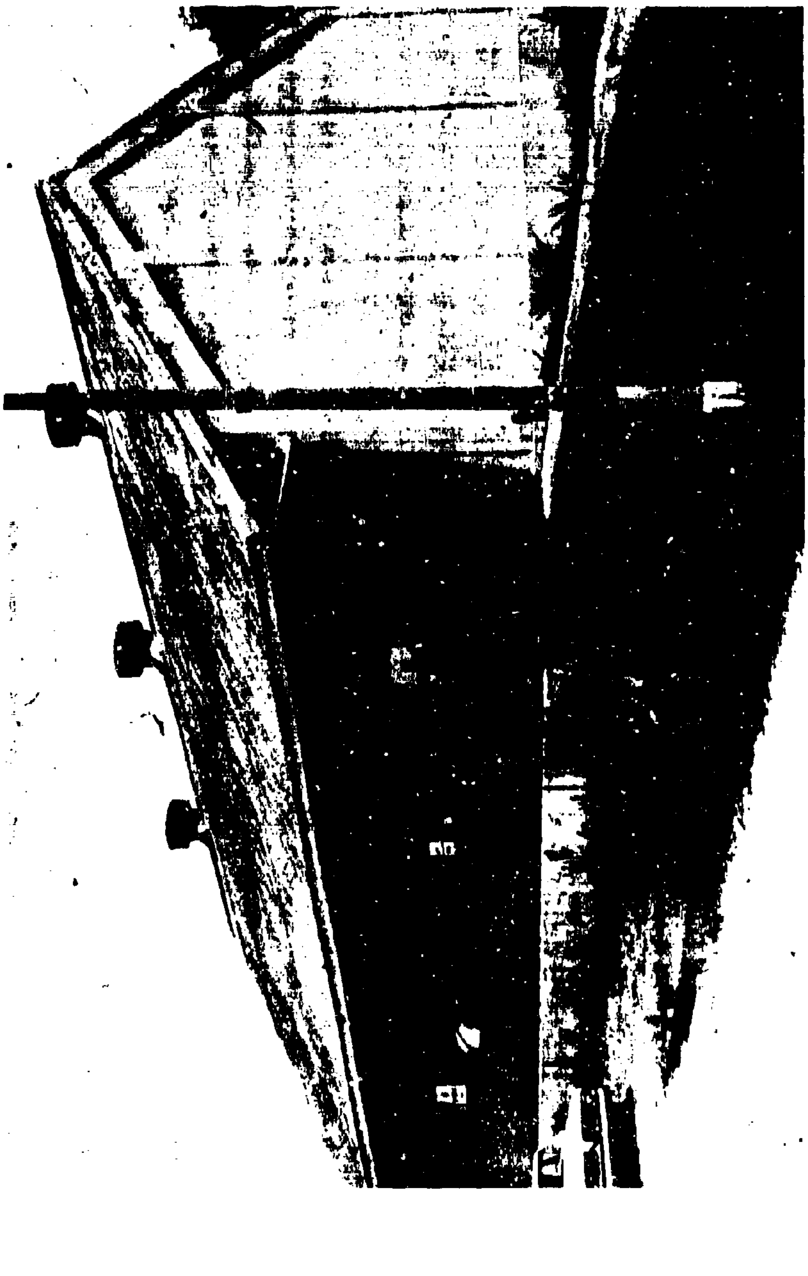


FIG. 19. NS, Roosevelt Roads, Puerto Rico, Magazine 1Y3.

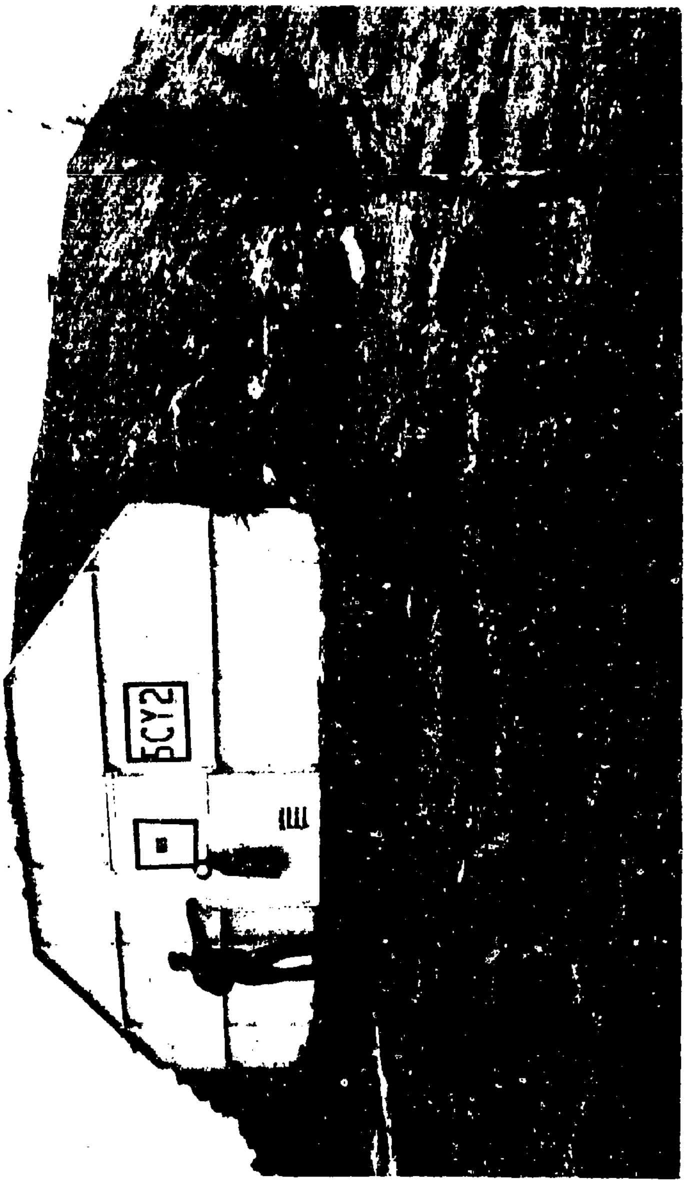


FIG. 20. NS, Bermuda, Magazine 5CY2.

FIG. 21. NS, Bermuda, Magazine 4MZ1.

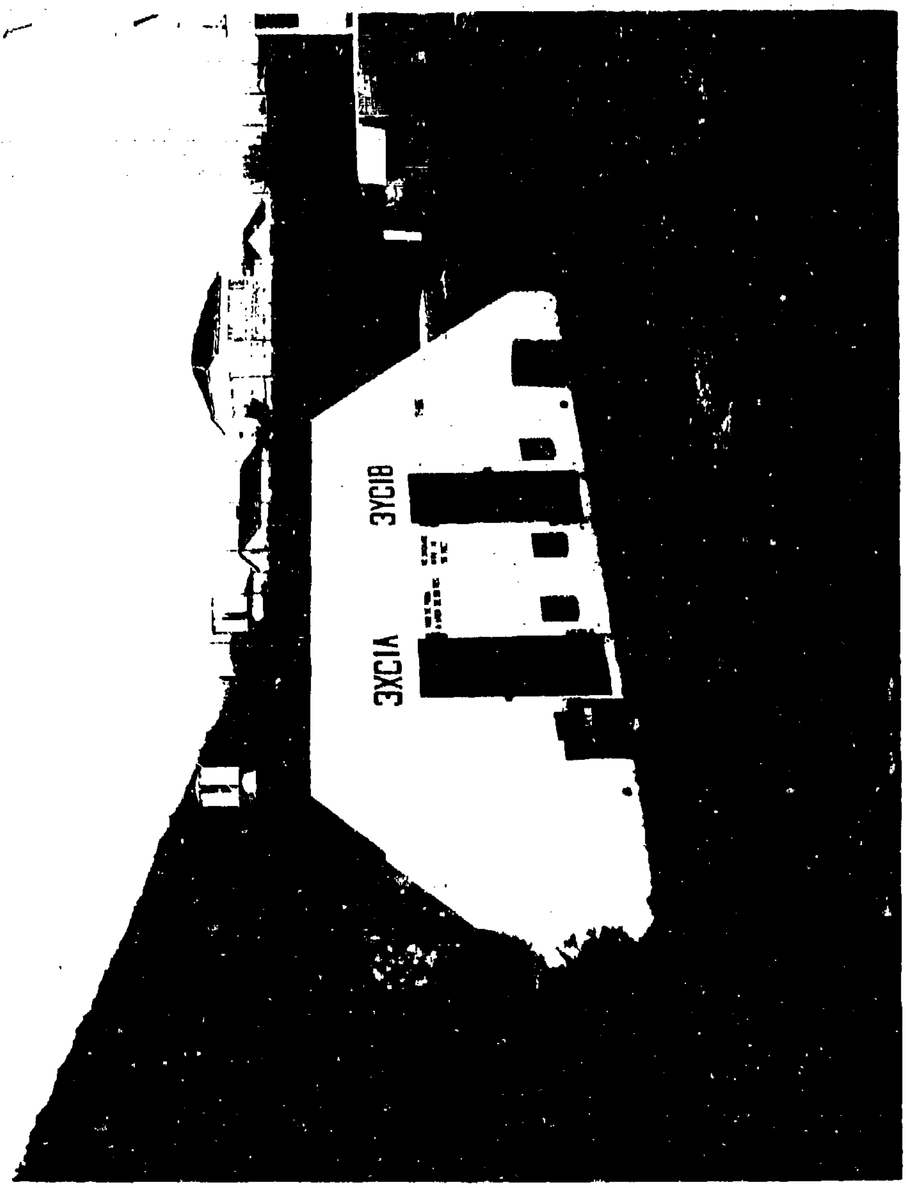


FIG. 22. NAF, Lajes, Azores, Magazines 3XC1A and 3YC1B.

FIG. 23. NAF, Lajes, Azores, Magazine 2XC9.

Appendix D

APPLICABLE STATISTICS

The standard deviation given along with the average maximum and minimum temperatures is a measure of dispersion (precision, reproducibility, spread, scatter, etc.) of temperatures within the month. If it is assumed that the temperature readings within each month are dispersed normally (Gaussian distribution), then the standard deviation (σ) can easily be used for calculating the percentage of temperature readings that would exceed nominal temperatures. The Gaussian distribution is a group of measurements that is symmetrical about the average. That is, the spread of measurements below and above the average would appear as equally descending bell-shaped curves on either side of the average.[1] Skewness is a term used to define the degree of departure from the symmetrical bell-shaped curve. Figure 24 presents this Gaussian information. The distributions for within-month temperatures differ from month to month in that the skewness of these distributions differ. However, the skewness is never so extreme that the assumption of normality, which can easily provide the prediction of approximate percentage points, can be discarded.

Temperature averages for the eight storage sites under consideration in this report are given in Tables 11 through 17. An explanation of the symbols is as follows:

D = Date, followed by month and year

LOC = Location; i.e., N.A.S., CUBA

N = Number of data points measured

X = Average

SD = Standard deviation

LT = Low temperature (minimum)

HT = High temperature (maximum)

[1] For a Gaussian distribution, the average (μ) minus 1 standard deviation (σ) to the average (μ) plus 1 standard deviation (σ), that is $\mu \pm 1\sigma$, includes approximately 68% of all the values of the distribution. Similarly $\mu \pm 2\sigma$ covers 95% and $\mu \pm 3\sigma$ covers 99% of all the values of the distribution.

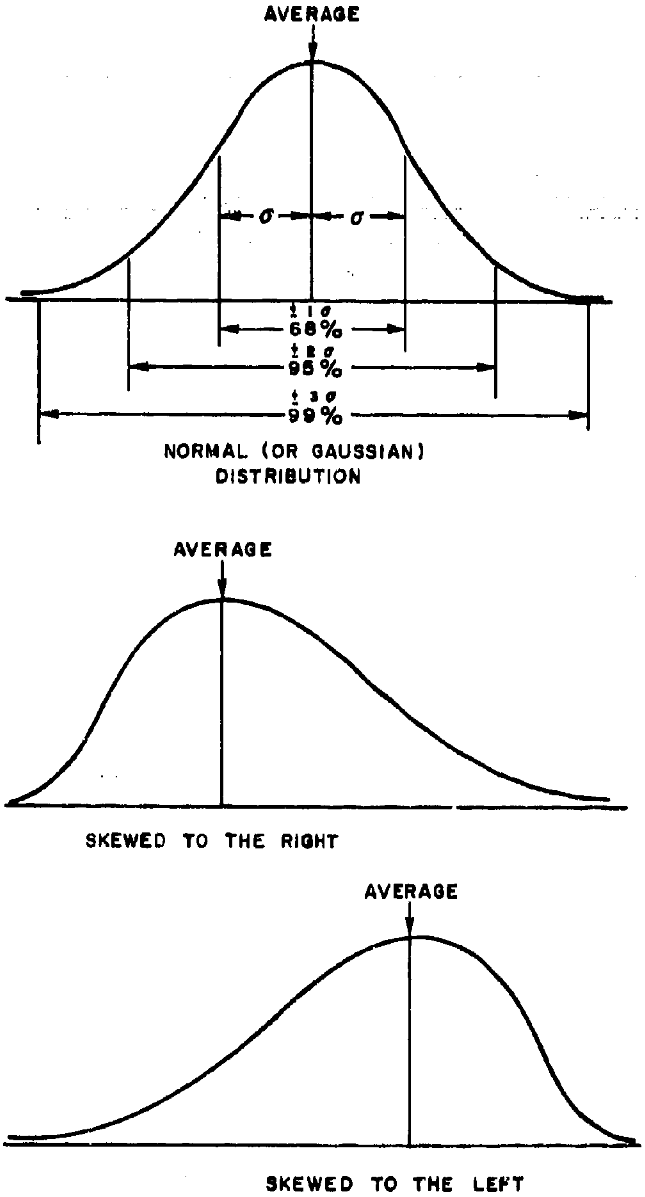


FIG. 24. Gaussian Distribution and Skewed Distributions.

TABLE 11. Minimum and Maximum Storage Temperature in Earth-Covered Storage Magazines, Monthly Summaries, NAS, Guantanamo Bay, Cuba

D	01	65	N.A.S.	CUBA	N	177	X	77.69	SD	2.892	LT
D	01	65	N.A.S.	CUBA	N	177	X	82.53	SD	1.943	HT
D	02	65	N.A.S.	CUBA	N	212	X	79.15	SD	2.407	LT
D	02	65	N.A.S.	CUBA	N	212	X	83.70	SD	2.066	HT
D	03	65	N.A.S.	CUBA	N	246	X	80.72	SD	2.357	LT
D	03	65	N.A.S.	CUBA	N	246	X	84.54	SD	2.240	HT
D	04	65	N.A.S.	CUBA	N	220	X	81.70	SD	2.204	LT
D	04	65	N.A.S.	CUBA	N	220	X	85.46	SD	2.342	HT
D	05	65	N.A.S.	CUBA	N	220	X	82.44	SD	1.858	LT
D	05	65	N.A.S.	CUBA	N	220	X	86.05	SD	2.045	HT
D	06	65	N.A.S.	CUBA	N	225	X	83.25	SD	2.073	LT
D	06	65	N.A.S.	CUBA	N	225	X	86.32	SD	2.217	HT
D	07	65	N.A.S.	CUBA	N	241	X	84.82	SD	1.713	LT
D	07	65	N.A.S.	CUBA	N	241	X	87.28	SD	2.203	HT
D	08	65	N.A.S.	CUBA	N	78	X	84.95	SD	1.298	LT
D	08	65	N.A.S.	CUBA	N	78	X	86.97	SD	1.358	HT
D	11	65	N.A.S.	CUBA	N	117	X	83.74	SD	2.093	LT
D	11	65	N.A.S.	CUBA	N	117	X	86.90	SD	1.793	HT
D	12	65	N.A.S.	CUBA	N	112	X	81.35	SD	2.915	LT
D	12	65	N.A.S.	CUBA	N	112	X	84.45	SD	2.585	HT
D	01	66	N.A.S.	CUBA	N	140	X	78.31	SD	3.079	LT
D	01	66	N.A.S.	CUBA	N	140	X	83.78	SD	3.342	HT
D	02	66	N.A.S.	CUBA	N	137	X	77.19	SD	3.207	LT
D	02	66	N.A.S.	CUBA	N	137	X	81.50	SD	2.752	HT
D	03	66	N.A.S.	CUBA	N	166	X	80.15	SD	2.327	LT
D	03	66	N.A.S.	CUBA	N	166	X	83.22	SD	2.516	HT
D	04	66	N.A.S.	CUBA	N	155	X	81.94	SD	2.090	LT
D	04	66	N.A.S.	CUBA	N	155	X	84.86	SD	2.658	HT
D	05	66	N.A.S.	CUBA	N	160	X	81.92	SD	2.752	LT
D	05	66	N.A.S.	CUBA	N	160	X	85.52	SD	2.811	HT
D	06	66	N.A.S.	CUBA	N	143	X	83.05	SD	2.209	LT
D	06	66	N.A.S.	CUBA	N	143	X	86.39	SD	2.475	HT
D	07	66	N.A.S.	CUBA	N	141	X	84.13	SD	2.165	LT
D	07	66	N.A.S.	CUBA	N	141	X	87.55	SD	2.297	HT
D	08	66	N.A.S.	CUBA	N	154	X	84.97	SD	2.040	LT
D	08	66	N.A.S.	CUBA	N	154	X	88.28	SD	2.413	HT
D	09	66	N.A.S.	CUBA	N	133	X	84.98	SD	2.870	LT
D	09	66	N.A.S.	CUBA	N	133	X	86.65	SD	2.270	HT
D	10	66	N.A.S.	CUBA	N	147	X	83.27	SD	1.769	LT
D	10	66	N.A.S.	CUBA	N	147	X	85.46	SD	1.990	HT
D	11	66	N.A.S.	CUBA	N	123	X	80.97	SD	2.279	LT
D	11	66	N.A.S.	CUBA	N	123	X	83.12	SD	2.242	HT
D	12	66	N.A.S.	CUBA	N	159	X	78.73	SD	2.492	LT
D	12	66	N.A.S.	CUBA	N	159	X	80.50	SD	1.990	HT

TABLE 11. (Continued)

D	01	67	N.A.S.	CUBA	N	179	X	79.46	SD	2.461	LT
D	01	67	N.A.S.	CUBA	N	179	X	82.39	SD	2.970	HT
D	02	67	N.A.S.	CUBA	N	170	X	79.95	SD	2.292	LT
D	02	67	N.A.S.	CUBA	N	170	X	82.66	SD	2.774	HT
D	03	67	N.A.S.	CUBA	N	188	X	79.97	SD	2.572	LT
D	03	67	N.A.S.	CUBA	N	188	X	83.21	SD	2.459	HT
D	04	67	N.A.S.	CUBA	N	190	X	80.33	SD	2.551	LT
D	04	67	N.A.S.	CUBA	N	190	X	83.15	SD	2.295	HT
D	05	67	N.A.S.	CUBA	N	190	X	82.15	SD	2.305	LT
D	05	67	N.A.S.	CUBA	N	190	X	85.13	SD	2.267	HT
D	06	67	N.A.S.	CUBA	N	202	X	83.60	SD	1.947	LT
D	06	67	N.A.S.	CUBA	N	202	X	86.04	SD	2.164	HT
D	07	67	N.A.S.	CUBA	N	214	X	84.01	SD	2.606	LT
D	07	67	N.A.S.	CUBA	N	214	X	87.03	SD	1.803	HT
D	08	67	N.A.S.	CUBA	N	217	X	85.09	SD	2.366	LT
D	08	67	N.A.S.	CUBA	N	217	X	87.90	SD	1.675	HT
D	09	67	N.A.S.	CUBA	N	208	X	85.84	SD	2.060	LT
D	09	67	N.A.S.	CUBA	N	208	X	88.70	SD	1.844	HT
D	10	67	N.A.S.	CUBA	N	214	X	84.40	SD	2.379	LT
D	10	67	N.A.S.	CUBA	N	214	X	87.56	SD	1.651	HT
D	11	67	N.A.S.	CUBA	N	209	X	82.46	SD	2.059	LT
D	11	67	N.A.S.	CUBA	N	209	X	85.42	SD	2.027	HT
D	01	68	N.A.S.	CUBA	N	403	X	78.39	SD	3.718	LT
D	01	68	N.A.S.	CUBA	N	403	X	82.61	SD	3.181	HT
D	02	68	N.A.S.	CUBA	N	454	X	77.00	SD	3.946	LT
D	02	68	N.A.S.	CUBA	N	454	X	81.25	SD	3.169	HT
D	03	68	N.A.S.	CUBA	N	559	X	77.61	SD	3.335	LT
D	03	68	N.A.S.	CUBA	N	559	X	82.43	SD	2.468	HT
D	04	68	N.A.S.	CUBA	N	565	X	79.06	SD	3.015	LT
D	04	68	N.A.S.	CUBA	N	565	X	84.43	SD	2.375	HT
D	05	68	N.A.S.	CUBA	N	767	X	82.56	SD	3.157	LT
D	05	68	N.A.S.	CUBA	N	767	X	87.70	SD	3.247	HT
D	06	68	N.A.S.	CUBA	N	326	X	84.46	SD	3.169	LT
D	06	68	N.A.S.	CUBA	N	326	X	89.06	SD	3.099	HT

TABLE 12. Minimum and Maximum Storage Temperature in Non-Earth-Covered Storage Magazines, Monthly Summaries, NAS, Guantanamo Bay, Cuba

D 01 65	N.A.S.	CUBA	N	71	X	66.15	SD	3.576	LT
D 01 65	N.A.S.	CUBA	N	71	X	79.30	SD	2.604	HT
D 02 65	N.A.S.	CUBA	N	108	X	68.47	SD	2.783	LT
D 02 65	N.A.S.	CUBA	N	108	X	80.16	SD	4.435	HT
D 03 65	N.A.S.	CUBA	N	125	X	71.01	SD	2.340	LT
D 03 65	N.A.S.	CUBA	N	125	X	81.54	SD	3.747	HT
D 04 65	N.A.S.	CUBA	N	101	X	71.67	SD	3.430	LT
D 04 65	N.A.S.	CUBA	N	101	X	82.39	SD	3.108	HT
D 05 65	N.A.S.	CUBA	N	108	X	73.94	SD	2.408	LT
D 05 65	N.A.S.	CUBA	N	108	X	83.49	SD	2.512	HT
D 06 65	N.A.S.	CUBA	N	107	X	74.91	SD	1.674	LT
D 06 65	N.A.S.	CUBA	N	107	X	85.59	SD	1.962	HT
D 07 65	N.A.S.	CUBA	N	112	X	76.69	SD	2.169	LT
D 07 65	N.A.S.	CUBA	N	112	X	85.69	SD	3.698	HT
D 08 65	N.A.S.	CUBA	N	93	X	76.33	SD	1.549	LT
D 08 65	N.A.S.	CUBA	N	93	X	86.58	SD	4.249	HT
D 11 65	N.A.S.	CUBA	N	40	X	73.60	SD	2.216	LT
D 11 65	N.A.S.	CUBA	N	40	X	85.65	SD	3.118	HT
D 12 65	N.A.S.	CUBA	N	46	X	69.98	SD	4.683	LT
D 12 65	N.A.S.	CUBA	N	46	X	83.91	SD	3.332	HT
D 01 66	N.A.S.	CUBA	N	63	X	69.79	SD	4.810	LT
D 01 66	N.A.S.	CUBA	N	63	X	82.40	SD	4.637	HT
D 02 66	N.A.S.	CUBA	N	116	X	70.12	SD	5.280	LT
D 02 66	N.A.S.	CUBA	N	116	X	81.49	SD	5.693	HT
D 03 66	N.A.S.	CUBA	N	148	X	74.35	SD	4.693	LT
D 03 66	N.A.S.	CUBA	N	148	X	82.10	SD	4.826	HT
D 04 66	N.A.S.	CUBA	N	141	X	76.03	SD	3.678	LT
D 04 66	N.A.S.	CUBA	N	141	X	84.49	SD	4.033	HT
D 05 66	N.A.S.	CUBA	N	128	X	75.90	SD	3.327	LT
D 05 66	N.A.S.	CUBA	N	128	X	86.12	SD	4.270	HT
D 01 68	N.A.S.	CUBA	N	184	X	70.24	SD	4.720	LT
D 01 68	N.A.S.	CUBA	N	184	X	81.13	SD	3.034	HT
D 02 68	N.A.S.	CUBA	N	204	X	71.03	SD	5.064	LT
D 02 68	N.A.S.	CUBA	N	204	X	80.47	SD	4.867	HT
D 03 68	N.A.S.	CUBA	N	186	X	69.99	SD	4.574	LT
D 03 68	N.A.S.	CUBA	N	186	X	82.05	SD	2.839	HT
D 04 68	N.A.S.	CUBA	N	151	X	71.00	SD	5.188	LT
D 04 68	N.A.S.	CUBA	N	151	X	83.23	SD	3.473	HT
D 05 68	N.A.S.	CUBA	N	155	X	76.54	SD	6.096	LT
D 05 68	N.A.S.	CUBA	N	155	X	87.51	SD	4.337	HT
D 06 68	N.A.S.	CUBA	N	150	X	78.96	SD	4.960	LT
D 06 68	N.A.S.	CUBA	N	150	X	88.09	SD	4.056	HT

TABLE 13. Minimum and Maximum Storage Temperature in Earth-Covered Storage Magazines, Monthly Summaries, NS, Roosevelt Roads, Puerto Rico

D	05	65	N.S.	PUERTO RICO	N	1512	X	81.24	SD	3.945	LT
D	05	65	N.S.	PUERTO RICO	N	1512	X	84.86	SD	4.056	HT
D	06	65	N.S.	PUERTO RICO	N	1753	X	81.66	SD	3.974	LT
D	06	65	N.S.	PUERTO RICO	N	1753	X	86.05	SD	3.844	HT
D	07	65	N.S.	PUERTO RICO	N	1758	X	82.74	SD	3.969	LT
D	07	65	N.S.	PUERTO RICO	N	1758	X	86.09	SD	4.185	HT
D	08	65	N.S.	PUERTO RICO	N	2051	X	83.07	SD	4.140	LT
D	08	65	N.S.	PUERTO RICO	N	2051	X	86.59	SD	3.972	HT
D	09	65	N.S.	PUERTO RICO	N	2078	X	84.10	SD	4.191	LT
D	09	65	N.S.	PUERTO RICO	N	2078	X	87.92	SD	3.848	HT
D	10	65	N.S.	PUERTO RICO	N	2127	X	83.37	SD	3.965	LT
D	10	65	N.S.	PUERTO RICO	N	2127	X	88.66	SD	3.940	HT
D	11	65	N.S.	PUERTO RICO	N	2582	X	82.07	SD	3.912	LT
D	11	65	N.S.	PUERTO RICO	N	2582	X	86.59	SD	4.135	HT
D	12	65	N.S.	PUERTO RICO	N	2831	X	80.05	SD	4.207	LT
D	12	65	N.S.	PUERTO RICO	N	2831	X	85.60	SD	4.164	HT
D	01	66	N.S.	PUERTO RICO	N	2794	X	79.34	SD	4.050	LT
D	01	66	N.S.	PUERTO RICO	N	2794	X	84.20	SD	4.121	HT
D	02	66	N.S.	PUERTO RICO	N	2421	X	78.95	SD	3.617	LT
D	02	66	N.S.	PUERTO RICO	N	2421	X	84.15	SD	3.851	HT
D	03	66	N.S.	PUERTO RICO	N	2776	X	79.58	SD	3.527	LT
D	03	66	N.S.	PUERTO RICO	N	2776	X	84.29	SD	3.570	HT
D	04	66	N.S.	PUERTO RICO	N	2643	X	81.53	SD	3.081	LT
D	04	66	N.S.	PUERTO RICO	N	2643	X	85.03	SD	3.641	HT
D	05	66	N.S.	PUERTO RICO	N	2875	X	81.15	SD	2.268	LT
D	05	66	N.S.	PUERTO RICO	N	2875	X	84.39	SD	2.302	HT
D	06	66	N.S.	PUERTO RICO	N	2865	X	82.65	SD	2.081	LT
D	06	66	N.S.	PUERTO RICO	N	2865	X	86.07	SD	2.441	HT
D	07	66	N.S.	PUERTO RICO	N	2875	X	83.79	SD	2.490	LT
D	07	66	N.S.	PUERTO RICO	N	2875	X	87.38	SD	2.601	HT
D	08	66	N.S.	PUERTO RICO	N	2907	X	83.67	SD	2.493	LT
D	08	66	N.S.	PUERTO RICO	N	2907	X	87.09	SD	2.869	HT
D	09	66	N.S.	PUERTO RICO	N	2716	X	83.83	SD	2.530	LT
D	09	66	N.S.	PUERTO RICO	N	2716	X	87.36	SD	2.831	HT
D	10	66	N.S.	PUERTO RICO	N	2791	X	82.78	SD	2.707	LT
D	10	66	N.S.	PUERTO RICO	N	2791	X	86.73	SD	3.337	HT
D	11	66	N.S.	PUERTO RICO	N	2783	X	82.33	SD	3.245	LT
D	11	66	N.S.	PUERTO RICO	N	2783	X	86.19	SD	3.975	HT
D	12	66	N.S.	PUERTO RICO	N	2908	X	80.27	SD	2.944	LT
D	12	66	N.S.	PUERTO RICO	N	2908	X	83.77	SD	3.684	HT

TABLE 13. (Continued)

D	01	67	N.S.	PUERTO RICO	N	2917	X	79.17	SD	2.802	LT
D	01	67	N.S.	PUERTO RICO	N	2917	X	82.58	SD	3.464	HT
D	02	67	N.S.	PUERTO RICO	N	2649	X	79.41	SD	2.857	LT
D	02	67	N.S.	PUERTO RICO	N	2649	X	82.75	SD	3.366	HT
D	03	67	N.S.	PUERTO RICO	N	2930	X	79.86	SD	2.972	LT
D	03	67	N.S.	PUERTO RICO	N	2930	X	83.30	SD	3.118	HT
D	04	67	N.S.	PUERTO RICO	N	2803	X	80.16	SD	2.902	LT
D	04	67	N.S.	PUERTO RICO	N	2803	X	84.20	SD	3.047	HT
D	05	67	N.S.	PUERTO RICO	N	2857	X	81.18	SD	2.730	LT
D	05	67	N.S.	PUERTO RICO	N	2857	X	84.46	SD	2.920	HT
D	06	67	N.S.	PUERTO RICO	N	2795	X	83.40	SD	2.800	LT
D	06	67	N.S.	PUERTO RICO	N	2795	X	86.81	SD	2.989	HT
D	07	67	N.S.	PUERTO RICO	N	3011	X	83.01	SD	2.642	LT
D	07	67	N.S.	PUERTO RICO	N	3011	X	85.88	SD	2.852	HT
D	08	67	N.S.	PUERTO RICO	N	2901	X	84.18	SD	2.660	LT
D	08	67	N.S.	PUERTO RICO	N	2901	X	87.32	SD	3.062	HT
D	09	67	N.S.	PUERTO RICO	N	2899	X	84.45	SD	2.519	LT
D	09	67	N.S.	PUERTO RICO	N	2899	X	87.40	SD	2.666	HT
D	10	67	N.S.	PUERTO RICO	N	2452	X	84.43	SD	2.616	LT
D	10	67	N.S.	PUERTO RICO	N	2452	X	88.13	SD	2.881	HT
D	11	67	N.S.	PUERTO RICO	N	2278	X	83.76	SD	2.716	LT
D	11	67	N.S.	PUERTO RICO	N	2278	X	87.54	SD	3.248	HT
D	12	67	N.S.	PUERTO RICO	N	2580	X	81.30	SD	2.832	LT
D	12	67	N.S.	PUERTO RICO	N	2580	X	85.57	SD	3.731	HT
D	01	68	N.S.	PUERTO RICO	N	2901	X	79.25	SD	2.861	LT
D	01	68	N.S.	PUERTO RICO	N	2901	X	83.72	SD	3.701	HT
D	02	68	N.S.	PUERTO RICO	N	2953	X	79.18	SD	3.476	LT
D	02	68	N.S.	PUERTO RICO	N	2953	X	84.21	SD	3.819	HT
D	03	68	N.S.	PUERTO RICO	N	3082	X	78.95	SD	3.002	LT
D	03	68	N.S.	PUERTO RICO	N	3082	X	85.40	SD	3.867	HT
D	04	68	N.S.	PUERTO RICO	N	2897	X	78.91	SD	2.776	LT
D	04	68	N.S.	PUERTO RICO	N	2897	X	85.10	SD	3.746	HT
D	05	68	N.S.	PUERTO RICO	N	3039	X	81.06	SD	3.154	LT
D	05	68	N.S.	PUERTO RICO	N	3039	X	85.95	SD	3.029	HT
D	06	68	N.S.	PUERTO RICO	N	524	X	83.00	SD	2.284	LT
D	06	68	N.S.	PUERTO RICO	N	524	X	86.72	SD	2.867	HT

TABLE 14. Minimum and Maximum Storage Temperature in Non-Earth-Covered Storage Magazines, Monthly Summaries, NS, Roosevelt Roads, Puerto Rico

D	10	65	N.S.	PUERTO RICO	N	136	X	80.23	SD	3.306	LT
D	10	65	N.S.	PUERTO RICO	N	136	X	88.51	SD	3.521	HT
D	11	65	N.S.	PUERTO RICO	N	177	X	79.34	SD	3.060	LT
D	11	65	N.S.	PUERTO RICO	N	177	X	86.10	SD	2.818	HT
D	12	65	N.S.	PUERTO RICO	N	201	X	75.09	SD	2.857	LT
D	12	65	N.S.	PUERTO RICO	N	201	X	84.89	SD	4.256	HT
D	01	66	N.S.	PUERTO RICO	N	207	X	75.13	SD	2.344	LT
D	01	66	N.S.	PUERTO RICO	N	207	X	83.98	SD	3.489	HT
D	02	66	N.S.	PUERTO RICO	N	196	X	75.96	SD	3.501	LT
D	02	66	N.S.	PUERTO RICO	N	196	X	84.04	SD	4.045	HT
D	03	66	N.S.	PUERTO RICO	N	207	X	76.33	SD	3.478	LT
D	03	66	N.S.	PUERTO RICO	N	207	X	84.34	SD	4.673	HT
D	04	66	N.S.	PUERTO RICO	N	203	X	78.33	SD	3.663	LT
D	04	66	N.S.	PUERTO RICO	N	203	X	86.50	SD	4.838	HT
D	05	66	N.S.	PUERTO RICO	N	202	X	78.87	SD	3.174	LT
D	05	66	N.S.	PUERTO RICO	N	202	X	86.31	SD	3.405	HT
D	06	66	N.S.	PUERTO RICO	N	204	X	80.76	SD	4.874	LT
D	06	66	N.S.	PUERTO RICO	N	204	X	86.84	SD	4.020	HT
D	07	66	N.S.	PUERTO RICO	N	87	X	80.52	SD	4.635	LT
D	07	66	N.S.	PUERTO RICO	N	87	X	86.11	SD	4.379	HT
D	08	66	N.S.	PUERTO RICO	N	209	X	82.17	SD	2.524	LT
D	08	66	N.S.	PUERTO RICO	N	209	X	86.22	SD	3.636	HT
D	09	66	N.S.	PUERTO RICO	N	203	X	82.08	SD	2.164	LT
D	09	66	N.S.	PUERTO RICO	N	203	X	86.56	SD	3.742	HT
D	10	66	N.S.	PUERTO RICO	N	197	X	80.56	SD	2.234	LT
D	10	66	N.S.	PUERTO RICO	N	197	X	86.43	SD	3.977	HT
D	11	66	N.S.	PUERTO RICO	N	221	X	78.10	SD	3.318	LT
D	11	66	N.S.	PUERTO RICO	N	221	X	84.02	SD	4.190	HT
D	12	66	N.S.	PUERTO RICO	N	210	X	75.95	SD	3.306	LT
D	12	66	N.S.	PUERTO RICO	N	210	X	82.10	SD	3.726	HT
D	01	67	N.S.	PUERTO RICO	N	210	X	75.95	SD	2.947	LT
D	01	67	N.S.	PUERTO RICO	N	210	X	82.36	SD	3.345	HT
D	02	67	N.S.	PUERTO RICO	N	191	X	76.72	SD	3.281	LT
D	02	67	N.S.	PUERTO RICO	N	191	X	83.02	SD	3.673	HT
D	03	67	N.S.	PUERTO RICO	N	213	X	75.53	SD	3.538	LT
D	03	67	N.S.	PUERTO RICO	N	213	X	84.07	SD	3.014	HT
D	04	67	N.S.	PUERTO RICO	N	196	X	75.65	SD	2.995	LT
D	04	67	N.S.	PUERTO RICO	N	196	X	86.16	SD	4.145	HT
D	05	67	N.S.	PUERTO RICO	N	201	X	78.60	SD	2.818	LT
D	05	67	N.S.	PUERTO RICO	N	201	X	87.64	SD	3.775	HT
D	06	67	N.S.	PUERTO RICO	N	188	X	80.77	SD	3.299	LT
D	06	67	N.S.	PUERTO RICO	N	188	X	90.70	SD	3.802	HT
D	07	67	N.S.	PUERTO RICO	N	155	X	80.41	SD	1.886	LT
D	07	67	N.S.	PUERTO RICO	N	155	X	88.17	SD	3.951	HT
D	08	67	N.S.	PUERTO RICO	N	192	X	81.37	SD	1.959	LT

TABLE 14. (Continued)

D	08	67	N.S.	PUERTO RICO	N	192	X	90.81	SD	4.120	HT
D	09	67	N.S.	PUERTO RICO	N	174	X	80.79	SD	2.111	LT
D	09	67	N.S.	PUERTO RICO	N	174	X	90.53	SD	3.837	HT
D	01	68	N.S.	PUERTO RICO	N	151	X	73.11	SD	2.922	LT
D	01	68	N.S.	PUERTO RICO	N	151	X	83.09	SD	3.456	HT
D	02	68	N.S.	PUERTO RICO	N	135	X	73.51	SD	4.182	LT
D	02	68	N.S.	PUERTO RICO	N	135	X	82.36	SD	3.977	HT
D	03	68	N.S.	PUERTO RICO	N	155	X	75.39	SD	2.825	LT
D	03	68	N.S.	PUERTO RICO	N	155	X	84.76	SD	4.703	HT
D	04	68	N.S.	PUERTO RICO	N	153	X	76.32	SD	2.930	LT
D	04	68	N.S.	PUERTO RICO	N	153	X	86.69	SD	3.862	HT
D	05	68	N.S.	PUERTO RICO	N	155	X	81.10	SD	2.461	LT
D	05	68	N.S.	PUERTO RICO	N	155	X	89.14	SD	3.942	HT
D	06	68	N.S.	PUERTO RICO	N	143	X	31.99	SD	2.481	LT
D	06	68	N.S.	PUERTO RICO	N	143	X	89.63	SD	3.367	HT

TABLE 15. Minimum and Maximum Storage Temperature in Earth-Covered Storage Magazines, Monthly Summaries, NS, Bermuda

D	12	65	N.S.	BERMUDA	N	744	X	61.93	SD	2.553	LT
D	12	65	N.S.	BERMUDA	N	744	X	67.14	SD	2.786	HT
D	01	66	N.S.	BERMUDA	N	580	X	57.87	SD	3.282	LT
D	01	66	N.S.	BERMUDA	N	580	X	64.10	SD	3.294	HT
D	02	66	N.S.	BERMUDA	N	504	X	58.44	SD	3.476	LT
D	02	66	N.S.	BERMUDA	N	504	X	63.59	SD	3.476	HT
D	03	66	N.S.	BERMUDA	N	391	X	60.88	SD	2.085	LT
D	03	66	N.S.	BERMUDA	N	391	X	66.93	SD	2.293	HT
D	04	66	N.S.	BERMUDA	N	357	X	61.62	SD	1.835	LT
D	04	66	N.S.	BERMUDA	N	357	X	68.50	SD	2.030	HT
D	05	66	N.S.	BERMUDA	N	399	X	65.56	SD	4.883	LT
D	05	66	N.S.	BERMUDA	N	399	X	74.79	SD	4.912	HT
D	06	66	N.S.	BERMUDA	N	396	X	75.29	SD	4.499	LT
D	06	66	N.S.	BERMUDA	N	396	X	83.74	SD	4.448	HT
D	07	66	N.S.	BERMUDA	N	366	X	79.48	SD	3.368	LT
D	07	66	N.S.	BERMUDA	N	366	X	85.05	SD	2.859	HT
D	08	66	N.S.	BERMUDA	N	412	X	83.50	SD	2.542	LT
D	08	66	N.S.	BERMUDA	N	412	X	87.99	SD	2.934	HT
D	09	66	N.S.	BERMUDA	N	378	X	78.91	SD	2.617	LT
D	09	66	N.S.	BERMUDA	N	378	X	82.80	SD	3.011	HT
D	10	66	N.S.	BERMUDA	N	375	X	73.95	SD	3.184	LT
D	10	66	N.S.	BERMUDA	N	375	X	78.55	SD	2.973	HT
D	11	66	N.S.	BERMUDA	N	360	X	67.85	SD	2.789	LT
D	11	66	N.S.	BERMUDA	N	360	X	72.56	SD	3.681	HT
D	12	66	N.S.	BERMUDA	N	378	X	62.43	SD	3.569	LT
D	12	66	N.S.	BERMUDA	N	378	X	67.54	SD	3.422	HT
D	01	67	N.S.	BERMUDA	N	360	X	61.90	SD	3.584	LT
D	01	67	N.S.	BERMUDA	N	360	X	67.24	SD	3.368	HT
D	02	67	N.S.	BERMUDA	N	497	X	61.79	SD	3.819	LT
D	02	67	N.S.	BERMUDA	N	497	X	66.86	SD	3.942	HT
D	03	67	N.S.	BERMUDA	N	645	X	60.44	SD	3.742	LT
D	03	67	N.S.	BERMUDA	N	645	X	65.81	SD	3.388	HT
D	04	67	N.S.	BERMUDA	N	540	X	62.53	SD	3.042	LT
D	04	67	N.S.	BERMUDA	N	540	X	68.12	SD	3.045	HT
D	05	67	N.S.	BERMUDA	N	594	X	68.03	SD	4.432	LT
D	05	67	N.S.	BERMUDA	N	594	X	74.40	SD	4.462	HT
D	06	67	N.S.	BERMUDA	N	625	X	72.68	SD	5.146	LT
D	06	67	N.S.	BERMUDA	N	625	X	78.19	SD	5.725	HT

TABLE 15. (Continued)

D	07	67	N.S.	BERMUDA	N	560	X	80.73	SD	3.428	LT
D	07	67	N.S.	BERMUDA	N	560	X	86.51	SD	4.417	HT
D	08	67	N.S.	BERMUDA	N	640	X	82.87	SD	2.929	LT
D	08	67	N.S.	BERMUDA	N	640	X	88.10	SD	3.431	HT
D	09	67	N.S.	BERMUDA	N	542	X	78.38	SD	3.312	LT
D	09	67	N.S.	BERMUDA	N	542	X	82.89	SD	3.681	HT
D	10	67	N.S.	BERMUDA	N	572	X	74.17	SD	3.636	LT
D	10	67	N.S.	BERMUDA	N	572	X	78.54	SD	3.949	HT
D	11	67	N.S.	BERMUDA	N	520	X	66.90	SD	3.608	LT
D	11	67	N.S.	BERMUDA	N	520	X	72.87	SD	3.840	HT
D	12	67	N.S.	BERMUDA	N	519	X	62.59	SD	3.314	LT
D	12	67	N.S.	BERMUDA	N	519	X	67.89	SD	3.524	HT
D	01	68	N.S.	BERMUDA	N	550	X	58.63	SD	3.411	LT
D	01	68	N.S.	BERMUDA	N	550	X	63.90	SD	3.614	HT
D	02	68	N.S.	BERMUDA	N	500	X	57.75	SD	2.681	LT
D	02	68	N.S.	BERMUDA	N	500	X	62.91	SD	3.340	HT
D	03	68	N.S.	BERMUDA	N	480	X	57.81	SD	4.149	LT
D	03	68	N.S.	BERMUDA	N	480	X	63.96	SD	3.945	HT
D	04	68	N.S.	BERMUDA	N	570	X	63.49	SD	2.987	LT
D	04	68	N.S.	BERMUDA	N	570	X	69.45	SD	3.450	HT
D	05	68	N.S.	BERMUDA	N	565	X	67.49	SD	3.788	LT
D	05	68	N.S.	BERMUDA	N	565	X	74.12	SD	4.173	HT
D	06	68	N.S.	BERMUDA	N	259	X	72.91	SD	3.657	LT
D	06	68	N.S.	BERMUDA	N	259	X	79.24	SD	4.865	HT

TABLE 16. Minimum and Maximum Storage Temperature in Non-Earth-Covered Storage Magazines, Monthly Summaries, NS, Bermuda

D	10	65	N.S. BERMUDA	N	59	X	72.92	SD	3.400	LT
D	10	65	N.S. BERMUDA	N	59	X	81.10	SD	3.532	HT
D	11	65	N.S. BERMUDA	N	55	X	67.31	SD	2.741	LT
D	11	65	N.S. BERMUDA	N	55	X	75.62	SD	3.603	HT
D	12	65	N.S. BERMUDA	N	153	X	62.62	SD	2.700	LT
D	12	65	N.S. BERMUDA	N	153	X	69.82	SD	3.775	HT
D	01	66	N.S. BERMUDA	N	151	X	58.47	SD	3.398	LT
D	01	66	N.S. BERMUDA	N	151	X	66.30	SD	3.869	HT
D	02	66	N.S. BERMUDA	N	137	X	57.99	SD	4.613	LT
D	02	66	N.S. BERMUDA	N	137	X	66.53	SD	3.720	HT
D	03	66	N.S. BERMUDA	N	127	X	60.13	SD	3.819	LT
D	03	66	N.S. BERMUDA	N	127	X	70.05	SD	3.590	HT
D	04	66	N.S. BERMUDA	N	124	X	61.06	SD	2.879	LT
D	04	66	N.S. BERMUDA	N	124	X	70.91	SD	3.364	HT
D	05	66	N.S. BERMUDA	N	125	X	67.26	SD	4.676	LT
D	05	66	N.S. BERMUDA	N	125	X	78.04	SD	3.942	HT
D	06	66	N.S. BERMUDA	N	104	X	74.60	SD	4.061	LT
D	06	66	N.S. BERMUDA	N	104	X	83.94	SD	3.869	HT
D	07	66	N.S. BERMUDA	N	106	X	78.28	SD	3.363	LT
D	07	66	N.S. BERMUDA	N	106	X	87.18	SD	2.640	HT
D	08	66	N.S. BERMUDA	N	108	X	82.72	SD	2.992	LT
D	08	66	N.S. BERMUDA	N	108	X	89.34	SD	3.142	HT
D	09	66	N.S. BERMUDA	N	102	X	79.64	SD	3.570	LT
D	09	66	N.S. BERMUDA	N	102	X	86.61	SD	3.956	HT
D	10	66	N.S. BERMUDA	N	103	X	75.31	SD	3.202	LT
D	10	66	N.S. BERMUDA	N	103	X	82.76	SD	4.609	HT
D	11	66	N.S. BERMUDA	N	100	X	69.23	SD	3.378	LT
D	11	66	N.S. BERMUDA	N	100	X	76.37	SD	4.846	HT
D	12	66	N.S. BERMUDA	N	93	X	62.77	SD	3.725	LT
D	12	66	N.S. BERMUDA	N	93	X	73.37	SD	5.505	HT
D	01	67	N.S. BERMUDA	N	60	X	61.57	SD	2.554	LT
D	01	67	N.S. BERMUDA	N	60	X	69.93	SD	4.356	HT
D	02	67	N.S. BERMUDA	N	54	X	61.67	SD	3.180	LT
D	02	67	N.S. BERMUDA	N	54	X	69.02	SD	4.901	HT
D	03	67	N.S. BERMUDA	N	69	X	60.20	SD	3.636	LT
D	03	67	N.S. BERMUDA	N	69	X	68.13	SD	4.811	HT
D	04	67	N.S. BERMUDA	N	60	X	61.65	SD	3.287	LT
D	04	67	N.S. BERMUDA	N	60	X	69.87	SD	4.102	HT
D	05	67	N.S. BERMUDA	N	65	X	66.43	SD	4.943	LT
D	05	67	N.S. BERMUDA	N	65	X	75.62	SD	3.948	HT
D	06	67	N.S. BERMUDA	N	66	X	71.55	SD	4.541	LT
D	06	67	N.S. BERMUDA	N	66	X	78.74	SD	4.744	HT

TABLE 16. (Continued)

D	07	67	N.S.	BERMUDA	N	60	X	79.30	SD	2.265	LT
D	07	67	N.S.	BERMUDA	N	60	X	86.58	SD	2.965	HT
D	08	67	N.S.	BERMUDA	N	69	X	82.39	SD	3.322	LT
D	08	67	N.S.	BERMUDA	N	69	X	89.75	SD	2.735	HT
D	09	67	N.S.	BERMUDA	N	60	X	79.52	SD	3.039	LT
D	09	67	N.S.	BERMUDA	N	60	X	86.23	SD	4.135	HT
D	10	67	N.S.	BERMUDA	N	66	X	75.17	SD	3.418	LT
D	10	67	N.S.	BERMUDA	N	66	X	82.24	SD	5.147	HT
D	11	67	N.S.	BERMUDA	N	60	X	68.37	SD	3.319	LT
D	11	67	N.S.	BERMUDA	N	60	X	76.72	SD	5.536	HT
D	12	67	N.S.	BERMUDA	N	60	X	63.03	SD	3.252	LT
D	12	67	N.S.	BERMUDA	N	60	X	71.07	SD	4.577	HT
D	01	68	N.S.	BERMUDA	N	66	X	59.80	SD	2.662	LT
D	01	68	N.S.	BERMUDA	N	66	X	66.74	SD	4.189	HT
D	02	68	N.S.	BERMUDA	N	60	X	59.23	SD	2.733	LT
D	02	68	N.S.	BERMUDA	N	60	X	67.17	SD	4.231	HT
D	03	68	N.S.	BERMUDA	N	60	X	59.00	SD	4.787	LT
D	03	68	N.S.	BERMUDA	N	60	X	68.43	SD	4.834	HT
D	04	68	N.S.	BERMUDA	N	66	X	65.18	SD	3.028	LT
D	04	68	N.S.	BERMUDA	N	66	X	73.33	SD	3.492	HT
D	05	68	N.S.	BERMUDA	N	63	X	68.75	SD	4.016	LT
D	05	68	N.S.	BERMUDA	N	63	X	77.29	SD	3.705	HT
D	06	68	N.S.	BERMUDA	N	30	X	73.47	SD	4.041	LT
D	06	68	N.S.	BERMUDA	N	30	X	81.87	SD	4.644	HT

TABLE 17. Minimum and Maximum Storage Temperature in Earth-Covered Storage Magazines, Monthly Summaries, NAF, Lajes, Azores

D	05	65	N.A.F.	AZORES	N	227	X	58.17	SD	4.131	LT
D	05	65	N.A.F.	AZORES	N	227	X	65.35	SD	3.978	HT
D	06	65	N.A.F.	AZORES	N	250	X	60.95	SD	4.689	LT
D	06	65	N.A.F.	AZORES	N	250	X	67.98	SD	5.132	HT
D	07	65	N.A.F.	AZORES	N	245	X	63.27	SD	6.027	LT
D	07	65	N.A.F.	AZORES	N	245	X	72.18	SD	4.244	HT
D	08	65	N.A.F.	AZORES	N	239	X	65.27	SD	4.702	LT
D	08	65	N.A.F.	AZORES	N	239	X	75.16	SD	4.985	HT
D	09	65	N.A.F.	AZORES	N	211	X	65.13	SD	3.669	LT
D	09	65	N.A.F.	AZORES	N	211	X	74.08	SD	5.047	HT
D	10	65	N.A.F.	AZORES	N	173	X	61.07	SD	4.179	LT
D	10	65	N.A.F.	AZORES	N	173	X	69.01	SD	5.596	HT
D	11	65	N.A.F.	AZORES	N	205	X	56.30	SD	4.586	LT
D	11	65	N.A.F.	AZORES	N	205	X	61.74	SD	5.197	HT
D	12	65	N.A.F.	AZORES	N	164	X	54.35	SD	4.328	LT
D	12	65	N.A.F.	AZORES	N	164	X	59.23	SD	4.151	HT
D	01	66	N.A.F.	AZORES	N	194	X	52.72	SD	3.711	LT
D	01	66	N.A.F.	AZORES	N	194	X	56.86	SD	3.777	HT
D	02	66	N.A.F.	AZORES	N	231	X	50.48	SD	5.113	LT
D	02	66	N.A.F.	AZORES	N	231	X	58.93	SD	4.710	HT
D	03	66	N.A.F.	AZORES	N	252	X	54.30	SD	3.360	LT
D	03	66	N.A.F.	AZORES	N	252	X	59.94	SD	4.006	HT
D	04	66	N.A.F.	AZORES	N	219	X	54.08	SD	3.694	LT
D	04	66	N.A.F.	AZORES	N	219	X	58.79	SD	4.428	HT
D	05	66	N.A.F.	AZORES	N	192	X	55.67	SD	4.321	LT
D	05	66	N.A.F.	AZORES	N	192	X	64.18	SD	4.685	HT
D	06	66	N.A.F.	AZORES	N	213	X	59.21	SD	4.103	LT
D	06	66	N.A.F.	AZORES	N	213	X	66.79	SD	4.891	HT
D	07	66	N.A.F.	AZORES	N	211	X	63.33	SD	3.757	LT
D	07	66	N.A.F.	AZORES	N	211	X	69.00	SD	4.996	HT
D	08	66	N.A.F.	AZORES	N	215	X	66.46	SD	3.831	LT
D	08	66	N.A.F.	AZORES	N	215	X	72.85	SD	4.925	HT
D	09	66	N.A.F.	AZORES	N	215	X	64.32	SD	3.630	LT
D	09	66	N.A.F.	AZORES	N	215	X	70.40	SD	5.257	HT
D	10	66	N.A.F.	AZORES	N	161	X	62.01	SD	3.404	LT
D	10	66	N.A.F.	AZORES	N	161	X	67.63	SD	5.393	HT
D	11	66	N.A.F.	AZORES	N	168	X	57.10	SD	3.796	LT
D	11	66	N.A.F.	AZORES	N	168	X	60.90	SD	4.500	HT
D	12	66	N.A.F.	AZORES	N	159	X	55.14	SD	3.610	LT
D	12	66	N.A.F.	AZORES	N	159	X	58.91	SD	4.856	HT

TABLE 17. (Continued)

D	01	67	N.A.F.	AZORES	N	205	X	53.06	SD	3.567	LT
D	01	67	N.A.F.	AZORES	N	205	X	57.42	SD	4.413	HT
D	02	67	N.A.F.	AZORES	N	201	X	51.63	SD	3.576	LT
D	02	67	N.A.F.	AZORES	N	201	X	56.42	SD	4.836	HT
D	03	67	N.A.F.	AZORES	N	247	X	54.17	SD	3.841	LT
D	03	67	N.A.F.	AZORES	N	247	X	60.62	SD	5.365	HT
D	04	67	N.A.F.	AZORES	N	191	X	54.80	SD	3.906	LT
D	04	67	N.A.F.	AZORES	N	191	X	61.69	SD	5.204	H
D	05	67	N.A.F.	AZORES	N	242	X	54.47	SD	3.838	
D	05	67	N.A.F.	AZORES	N	242	X	61.73	SD	5.476	
D	06	67	N.A.F.	AZORES	N	226	X	60.38	SD	3.665	LT
D	06	67	N.A.F.	AZORES	N	226	X	67.91	SD	5.034	HT
D	07	67	N.A.F.	AZORES	N	212	X	63.60	SD	3.784	LT
D	07	67	N.A.F.	AZORES	N	212	X	71.81	SD	5.540	HT
D	08	67	N.A.F.	AZORES	N	236	X	65.64	SD	3.554	LT
D	08	67	N.A.F.	AZORES	N	236	X	75.03	SD	5.111	HT
D	09	67	N.A.F.	AZORES	N	197	X	64.67	SD	3.335	LT
D	09	67	N.A.F.	AZORES	N	197	X	73.37	SD	5.938	HT
D	10	67	N.A.F.	AZORES	N	212	X	63.12	SD	4.111	LT
D	10	67	N.A.F.	AZORES	N	212	X	70.27	SD	5.604	HT
D	11	67	N.A.F.	AZORES	N	203	X	57.31	SD	4.019	LT
D	11	67	N.A.F.	AZORES	N	203	X	62.90	SD	6.010	HT
D	12	67	N.A.F.	AZORES	N	194	X	56.37	SD	3.223	LT
D	12	67	N.A.F.	AZORES	N	194	X	59.68	SD	4.216	HT
D	01	68	N.A.F.	AZORES	N	176	X	53.58	SD	3.503	LT
D	01	68	N.A.F.	AZORES	N	176	X	58.23	SD	4.712	HT
D	02	68	N.A.F.	AZORES	N	169	X	51.49	SD	3.637	LT
D	02	68	N.A.F.	AZORES	N	169	X	58.10	SD	4.989	HT
D	03	68	N.A.F.	AZORES	N	170	X	50.74	SD	3.413	LT
D	03	68	N.A.F.	AZORES	N	170	X	58.66	SD	5.308	HT
D	04	68	N.A.F.	AZORES	N	217	X	51.91	SD	3.669	LT
D	04	68	N.A.F.	AZORES	N	217	X	58.84	SD	5.035	HT
D	05	68	N.A.F.	AZORES	N	174	X	54.98	SD	3.862	LT
D	05	68	N.A.F.	AZORES	N	174	X	63.34	SD	5.345	HT

TABLE 18. Minimum and Maximum Storage Temperature in Earth-Covered Storage Magazines, Monthly Summaries, NAS, Guantanamo Bay, Cuba and NS, Roosevelt Roads, Puerto Rico

1	65	CUBA + P.R.	N	177	X	77.69	LT
1	65	CUBA + P.R.	N	177	X	82.53	HT
2	65	CUBA + P.R.	N	212	X	79.15	LT
2	65	CUBA + P.R.	N	212	X	83.70	HT
3	65	CUBA + P.R.	N	246	X	80.72	LT
3	65	CUBA + P.R.	N	246	X	84.54	HT
4	65	CUBA + P.R.	N	220	X	81.70	LT
4	65	CUBA + P.R.	N	220	X	85.46	HT
5	65	CUBA + P.R.	N	1732	X	81.39	LT
5	65	CUBA + P.R.	N	1732	X	85.01	HT
6	65	CUBA + P.R.	N	1978	X	81.84	LT
6	65	CUBA + P.R.	N	1978	X	86.08	HT
7	65	CUBA + P.R.	N	1999	X	82.99	LT
7	65	CUBA + P.R.	N	1999	X	86.23	HT
8	65	CUBA + P.R.	N	2129	X	83.14	LT
8	65	CUBA + P.R.	N	2129	X	87.01	HT
9	65	CUBA + P.R.	N	2078	X	84.10	LT
9	65	CUBA + P.R.	N	2078	X	87.92	HT
10	65	CUBA + P.R.	N	2127	X	83.37	LT
10	65	CUBA + P.R.	N	2127	X	88.66	HT
11	65	CUBA + P.R.	N	2699	X	82.14	LT
11	65	CUBA + P.R.	N	2699	X	86.60	HT
12	65	CUBA + P.R.	N	2943	X	80.37	LT
12	65	CUBA + P.R.	N	2943	X	85.56	HT
1	66	CUBA + P.R.	N	2934	X	79.29	LT
1	66	CUBA + P.R.	N	2934	X	84.18	HT
2	66	CUBA + P.R.	N	2558	X	78.86	LT
2	66	CUBA + P.R.	N	2558	X	84.01	HT
3	66	CUBA + P.R.	N	2942	X	79.61	LT
3	66	CUBA + P.R.	N	2942	X	84.23	HT
4	66	CUBA + P.R.	N	2798	X	81.55	LT
4	66	CUBA + P.R.	N	2798	X	85.02	HT
5	66	CUBA + P.R.	N	3035	X	81.19	LT
5	66	CUBA + P.R.	N	3035	X	84.45	HT
6	66	CUBA + P.R.	N	3008	X	82.67	LT
6	66	CUBA + P.R.	N	3008	X	86.09	HT
7	66	CUBA + P.R.	N	3016	X	83.81	LT
7	66	CUBA + P.R.	N	3016	X	87.39	HT
8	66	CUBA + P.R.	N	3061	X	83.74	LT
8	66	CUBA + P.R.	N	3061	X	87.15	HT
9	66	CUBA + P.R.	N	2849	X	83.88	LT
9	66	CUBA + P.R.	N	2849	X	87.42	HT
10	66	CUBA + P.R.	N	2938	X	82.80	LT
10	66	CUBA + P.R.	N	2938	X	86.67	HT

TABLE 18. (Continued)

11	66	CUBA + P.R.	N	2906	X	82.27	LT
11	66	CUBA + P.R.	N	2906	X	86.06	HT
12	66	CUBA + P.R.	N	3067	X	80.19	LT
12	66	CUBA + P.R.	N	6067	X	83.60	HT
1	67	CUBA + P.R.	N	3096	X	79.19	LT
1	67	CUBA + P.R.	N	3096	X	82.56	HT
2	67	CUBA + P.R.	N	2819	X	79.44	LT
2	67	CUBA + P.R.	N	2819	X	82.74	HT
3	67	CUBA + P.R.	N	3118	X	79.87	LT
3	67	CUBA + P.R.	N	3118	X	83.29	HT
4	67	CUBA + P.R.	N	2993	X	80.17	LT
4	67	CUBA + P.R.	N	2993	X	84.13	HT
5	67	CUBA + P.R.	N	3047	X	81.24	LT
5	67	CUBA + P.R.	N	3047	X	84.50	HT
6	67	CUBA + P.R.	N	2997	X	83.41	LT
6	67	CUBA + P.R.	N	2997	X	86.76	HT
7	67	CUBA + P.R.	N	3225	X	83.33	LT
7	67	CUBA + P.R.	N	3225	X	85.96	HT
8	67	CUBA + P.R.	N	3118	X	84.17	LT
8	67	CUBA + P.R.	N	3118	X	87.36	HT
9	67	CUBA + P.R.	N	3107	X	84.54	LT
9	67	CUBA + P.R.	N	3107	X	87.49	HT
10	67	CUBA + P.R.	N	2666	X	84.43	LT
10	67	CUBA + P.R.	N	2666	X	88.08	HT
11	67	CUBA + P.R.	N	2487	X	83.65	LT
11	67	CUBA + P.R.	N	2487	X	87.36	HT
12	67	CUBA + P.R.	N	2580	X	81.30	LT
12	67	CUBA + P.R.	N	2580	X	85.57	HT
1	68	CUBA + P.R.	N	3304	X	79.15	LT
1	68	CUBA + P.R.	N	3304	X	33.58	HT
2	68	CUBA + P.R.	N	3408	X	78.89	LT
2	68	CUBA + P.R.	N	3408	X	83.81	HT
3	68	CUBA + P.R.	N	3641	X	78.74	LT
3	68	CUBA + P.R.	N	3641	X	84.94	HT
4	68	CUBA + P.R.	N	3462	X	78.93	LT
4	68	CUBA + P.R.	N	3462	X	84.99	HT
5	68	CUBA + P.R.	N	3806	X	81.36	LT
5	68	CUBA + P.R.	N	3806	X	86.30	HT
6	68	CUBA + P.R.	N	850	X	83.56	LT
6	68	CUBA + P.R.	N	850	X	87.62	HT

TABLE 19. Minimum and Maximum Storage Temperature in Non-Earth-Covered Storage Magazines, Monthly Summaries, NAS, Guantanamo Bay, Cuba and NS, Roosevelt Roads, Puerto Rico

1	65	CUBA + P.R.	N	71	X	66.15	LT
1	65	CUBA + P.R.	N	71	X	79.30	HT
2	65	CUBA + P.R.	N	108	X	68.47	LT
2	65	CUBA + P.R.	N	108	X	80.16	HT
3	65	CUBA + P.R.	N	125	X	71.01	LT
3	65	CUBA + P.R.	N	125	X	81.54	HT
4	65	CUBA + P.R.	N	101	X	71.67	LT
4	65	CUBA + P.R.	N	101	X	82.39	HT
5	65	CUBA + P.R.	N	108	X	73.94	LT
5	65	CUBA + P.R.	N	108	X	83.49	HT
6	65	CUBA + P.R.	N	107	X	74.91	LT
6	65	CUBA + P.R.	N	107	X	85.59	HT
7	65	CUBA + P.R.	N	112	X	76.69	LT
7	65	CUBA + P.R.	N	112	X	85.69	HT
8	65	CUBA + P.R.	N	93	X	76.33	LT
8	65	CUBA + P.R.	N	93	X	86.58	HT
10	65	CUBA + P.R.	N	136	X	80.23	LT
10	65	CUBA + P.R.	N	136	X	88.51	HT
11	65	CUBA + P.R.	N	217	X	78.28	LT
11	65	CUBA + P.R.	N	217	X	86.02	HT
12	65	CUBA + P.R.	N	247	X	74.14	LT
12	65	CUBA + P.R.	N	247	X	84.71	HT
1	66	CUBA + P.R.	N	270	X	73.88	LT
1	66	CUBA + P.R.	N	270	X	83.61	HT
2	66	CUBA + P.R.	N	312	X	73.79	LT
2	66	CUBA + P.R.	N	312	X	83.09	HT
3	66	CUBA + P.R.	N	355	X	75.50	LT
3	66	CUBA + P.R.	N	355	X	83.41	HT
4	66	CUBA + P.R.	N	344	X	77.39	LT
4	66	CUBA + P.R.	N	344	X	85.68	HT
5	66	CUBA + P.R.	N	330	X	77.72	LT
5	66	CUBA + P.R.	N	330	X	86.24	HT
6	66	CUBA + P.R.	N	204	X	80.76	LT
6	66	CUBA + P.R.	N	204	X	86.84	HT
7	66	CUBA + P.R.	N	87	X	80.52	LT
7	66	CUBA + P.R.	N	87	X	86.11	HT
8	66	CUBA + P.R.	N	209	X	82.17	LT
8	66	CUBA + P.R.	N	209	X	86.22	HT
9	66	CUBA + P.R.	N	203	X	82.08	LT
9	66	CUBA + P.R.	N	203	X	86.56	HT
10	66	CUBA + P.R.	N	197	X	80.56	LT
10	66	CUBA + P.R.	N	197	X	86.43	HT
11	66	CUBA + P.R.	N	221	X	78.10	LT
11	66	CUBA + P.R.	N	221	X	84.02	HT
12	66	CUBA + P.R.	N	210	X	75.95	LT
12	66	CUBA + P.R.	N	210	X	82.10	HT

TABLE 19. (Continued)

1	67	CUBA + P.R.	N	210	X	75.95	LT
1	67	CUBA + P.R.	N	210	X	82.36	HT
2	67	CUBA + P.R.	N	191	X	76.72	LT
2	67	CUBA + P.R.	N	191	X	83.02	HT
3	67	CUBA + P.R.	N	213	X	75.53	LT
3	67	CUBA + P.R.	N	213	X	84.07	HT
4	67	CUBA + P.R.	N	196	X	75.65	LT
4	67	CUBA + P.R.	N	196	X	86.16	HT
5	67	CUBA + P.R.	N	201	X	78.60	LT
5	67	CUBA + P.R.	N	201	X	87.64	HT
6	67	CUBA + P.R.	N	188	X	80.77	LT
6	67	CUBA + P.R.	N	188	X	90.70	HT
7	67	CUBA + P.R.	N	155	X	80.41	LT
7	67	CUBA + P.R.	N	155	X	88.17	HT
8	67	CUBA + P.R.	N	192	X	81.37	LT
8	67	CUBA + P.R.	N	192	X	90.81	HT
9	67	CUBA + P.R.	N	174	X	80.79	LT
9	67	CUBA + P.R.	N	174	X	90.53	HT
1	68	CUBA + P.R.	N	335	X	71.53	LT
1	68	CUBA + P.R.	N	335	X	82.01	HT
2	68	CUBA + P.R.	N	339	X	72.02	LT
2	68	CUBA + P.R.	N	339	X	81.22	HT
3	68	CUBA + P.R.	N	341	X	72.44	LT
3	68	CUBA + P.R.	N	341	X	83.28	HT
4	68	CUBA + P.R.	N	304	X	73.68	LT
4	68	CUBA + P.R.	N	304	X	84.97	HT
5	68	CUBA + P.R.	N	310	X	78.82	LT
5	68	CUBA + P.R.	N	310	X	88.33	HT
6	68	CUBA + P.R.	N	293	X	80.44	LT
6	68	CUBA + P.R.	N	293	X	88.84	HT

Appendix E

STATISTICAL NOTES AND IMPLICATIONS

The following points concerning the data should be considered before making final judgment on the contents of this report.

(1) The time intervals at which temperature readings were taken were not equal. The maximum and minimum temperature readings were those encountered within the magazine during those intervals of time. The difference in reading-time intervals biases the results in both maximum and minimum directions. It has been found that the temperatures in some magazines were recorded daily, weekly, biweekly, or monthly, or less frequently, depending on the material and procedures cogent to each facility. This, of course, biases the results upward, since a high temperature for 1 day may be the recorded temperature for that magazine for a 1-week or greater period instead of for that specific day.

(2) The amount of ammunition in the storage magazines is not always constant. The absorption of heat by the ammunition (dependent on the quantity of material) within the magazine could cause differences in temperature readings that are not accounted for.

(3) The frequency at which the magazine doors are opened will also influence the temperature readings. This effect is also not accounted for.

(4) In some cases inaccuracies of thermometers are large and the thermometers are not read properly. These effects were also not considered.

(5) The Monthly Temperature Summaries (Appendix B) indicating the number of maximum temperature readings greater than nominal temperatures is exclusive of minimum temperature readings. Perhaps the minimum temperatures could be used in such a way as to provide the time duration of these nominal temperatures. If, for example, the minimum temperature recorded for a reading interval is 85°F, it is certain that the temperature within the storage magazine was no lower than 85°F during that reading interval.

The number of data points, the averages, and the standard deviations of temperature readings for each month was reported in Appendix B and D because these statistics provide information concerning the distribution of temperature readings. If it is assumed that these temperature measurements are normally distributed (the Gaussian curve) within each month, and the data in most cases do not indicate that this is a poor assumption for practical use, the standard deviation can be used to attach probabilities of occurrences to nominal temperature values. For example, in October 1965, for earth-covered magazines at NS, Roosevelt

Roads, Puerto Rico, the sample size is 2127, the average maximum temperature is 88.66°F, and the standard deviation is 3.940. From this and the assumption that the data is representative of the storage temperatures encountered in October, the probability of experiencing a storage temperature of 99.48 (88.66 + 3σ)°F or more in an earth-covered magazine is less than 0.005.

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13. ABSTRACT

Storage magazine temperature measurements (140,920 data points) from Cuba, Puerto Rico, Bermuda, and the Azores are under study. This data collection is for the purpose of establishing a temperature criterion by statistical methods for ordnance stored in explosive hazard magazines.

This report is the fifth of the series of reports that covers explosive hazard magazine storage temperatures in most parts of the world. This report includes 24 figures and 17 tables.

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Magazine temperature at NAS, Guantanamo Bay, Cuba NS, Roosevelt Roads, Puerto Rico NS, Bermuda NAF, Lajes, Azores						
Temperature data retrieval Temperature data reduction						